Metals Review

THE NEWS DIGEST MAGAZINE

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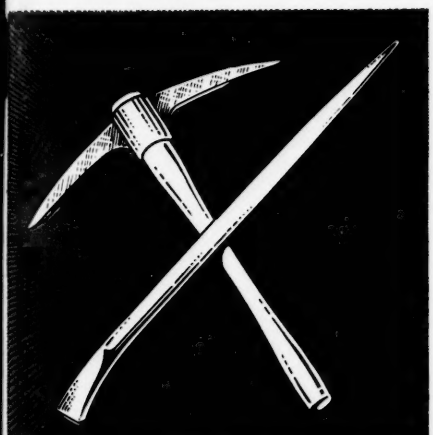

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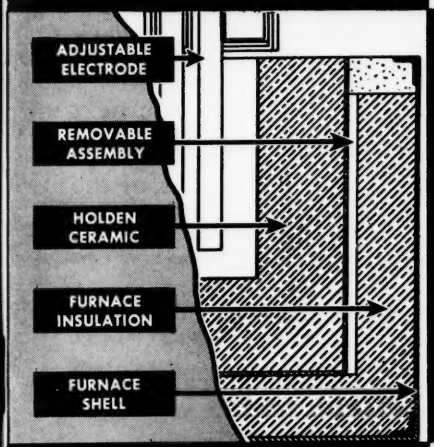

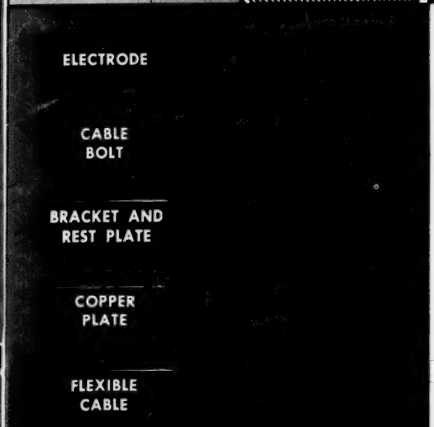

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Metals Review

THE NEWS DIGEST MAGAZINE

RAY T. BAYLESS, Publishing Director MARJORIE R. HYSLOP, Editor GEORGE H. LOUGHNER, Production Manager

VOLUME XXII, No. 5 May, 1949

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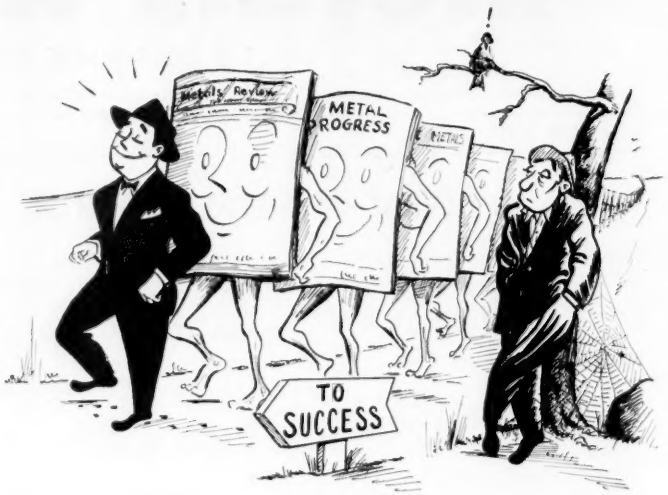
in the March of Metallurgy?

The leader knows what's going on in the world of metals. He is aware of new developments, new products, new materials, new research, news of industry.

The laggard can't keep up with his reading—or doesn't try—or doesn't care—or wants to but just doesn't know how.

Are *You* aware of this month's news-making events? How many of the questions below can *you* answer?

All of the information required is contained in this issue of *Metals Review*. Check the right answers, fill in the page number and source, sign, and mail to *Metals Review*. The names of all who submit a complete set of correct answers and sources will be published in the June issue.



GET *YOUR* NAME ON *METALS REVIEW'S* HONOR ROLL OF THE WELL INFORMED

1. What is the top range for satisfactory service of tungsten-molybdenum thermocouples?
   (a) 3990° F.
   (b) 3150° F.
   (c) 2700° F.
   (d) 4340° F.
   Answer found on page ——; item No. ——.

2. What material has been found superior to babbitt metal for marine turbine construction?
   (a) Cadmium-base alloys
   (b) Lead-bronze alloy
   (c) Indium-tin plated bearings
   (d) Cold worked aluminum-cadmium-silicon alloy
   Answer found on page ——; item No. ——.

3. What series of alloys has recently been studied in an effort to develop one for use under stress at 815° C?
   (a) Cobalt-chromium
   (b) Titanium-nickel
   (c) Nickel-aluminum-molybdenum
   (d) Chromium-nickel-tungsten
   Answer found on page ——; item No. ——.

4. What is the optimum charging rate for an openhearth furnace?
   (a) A rate just above the rate of heat transfer.
   (b) A uniform rate that holds the furnace roof just below the maximum safe value.
   (c) A rate determined by the time to melt the charge below the liquid surface.
   Answer found on page ——; item No. ——.

5. How can the oxide films that form on beryllium-copper during heat treatment be removed?
   (a) By electrolytic cleaning.
   (b) By a specialized pickling procedure.
   (c) By tempering in an oil bath.
   (d) By polishing with an aluminum oxide abrasive.
   Answer found on page ——; item No. ——.

6. What combination of factors must be considered for optimum hardness and appearance in chromium plating?
   (a) The proper relationship between current density, temperature and chromic acid concentration.
   (b) Agitation of the bath together with a cathode area about three times the area of the anode.
   (c) Use of a solution of chromic chloride in ethylene diamine.
   (d) Proper relationship between the sulphate iron and throwing power.
   Answer found on page ——.

7. What is the turbo-hearth process?
   (a) An isothermal quenching process using a salt bath agitated by compressed air.
   (b) A method of testing alloys for high-temperature service in gas turbines, utilizing a gas-heated hearth furnace.
   (c) A method of manufacturing steel of openhearth quality in a side-blown basic-lined vessel.
   Answer found on page ——.

8. What was the subject of a series of four educational lectures sponsored by the A.S.M. during the Western Metal Congress last month?
   (a) Metals for low temperatures
   (b) Boron-treated steels
   (c) Aircraft materials
   (d) Metallography
   Answer found on page ——.

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Testing and Inspection

Improvements in the Common Mechanical Text Methods and Equipment, Some New Ways of Predicting Behavior of Metals, and Unusual Kinks in Inspection, as Revealed in the Technical Writings of the Past Year

By J. T. Stacy

Research Engineer, Battelle Memorial Institute

TESTING AND inspection embrace a broad field of industrial and scientific endeavor. Testing devices, while multiplying in number and increasing in complexity, are tending to become more automatic in operation, thus resulting in faster and more accurate inspection. Investigations are being carried on to discover the essential value of testing procedures and to eliminate unnecessary effort in the proving of materials. The present article points out some of the developments in this domain as disclosed by recent literature.

Tensile Testing

The most general method of evaluating the properties of metals is the tensile test. Also, it is usually the most lucrative of the mechanical tests. By this means the tester can obtain a figure for the ultimate uniaxial stress to which the metal may be loaded, a measure of ductility, and values useful in design such as the modulus of elasticity and the yield point, yield strength, or proportional limit.

Tensile tests are conducted at all feasible temperatures. Some low-temperature tensile-testing equipment uses liquid nitrogen or hydrogen to attain the desired frigidity (9-24, Feb., 1949; 9a-3, Feb., 1948).* Although high-temperature tensile testing is not uncommon, creep or stress-rupture tests are thought to be more indicative of metal behavior under conditions usually encountered in service.

Not only can tensile tests be conducted at various temperatures, but machines have been built to test over a great range of strengths. At present the world's largest machine has a 2500-ton capacity; it is suitable for tension, compression, or bend experiments with an accuracy of 0.5% (9a-97, Dec., 1948). Inasmuch as materials in service are seldom subjected to pure tension, various machines are constantly being built to test metals under combined stresses such as torsion-tension, tension in two directions, tension-bending, and others (9a-53, Sept., 1948).

Most specifications require that a tension test shall be conducted at a certain rate of loading. Sowa (9b-2, March 1948) has conducted tensile tests on annealed S.A.E. 1045 steel to determine the effect of the rate of loading on test data. He found that it was possible to vary the yield point 6.3%, but could not find any correlation between the breaking load and speed of testing. Reduction in area and elongation remained constant despite these deviations. Miklowitz (9b-49, Oct. 1948), investigating the mode of yielding and fracture of flat tensile bars, found that necking strains are dependent upon head restraint and the restraining action of the bar heads, which becomes more intense as the width of the bar increases.

The dependence of the stress-strain relationship and yield strength upon the direction of cold working in aluminum alloy plate has been pointed out (24d-12, May 1948). The effect of length of specimen on the strength of steel wire, the effect of size on the breaking stress of rods, and a mathematical expression for the stress-strain relationship are also among recent studies (24b-43 and 24a-80, May 1948; 9-12, Feb. 1949).

With the advent of high-temperature gas turbines the testing of large rotating disks has received added impetus. Such disk tests involve biaxial stressing. Equipment has been constructed for testing up to 35,000 r.p.m. in vacuum at room temperature and up to 94,000 r.p.m. at 1750° F. (9b-31, July 1948; 9b-40, Sept. 1948). Disks welded, unwelded, perforated, and bucketed have been studied. Good ductility is important in preventing minor defects from affecting the bursting strength, but the ratio of disk strength to tensile strength appears to be relatively independent of ductility.

Hardness

Hardness is usually defined as the resistance of a material to penetration. One of the earliest experimenters to devise a hardness test was Reaumur in 1722. Hardness testers today are legion. Tests may be made by the penetration of an indenter under static or dynamic loading, by the rebound of an anvil from the surface under test, by abrasion or wear, or by scratching. New methods include measuring the magnetic permeability (which varies inversely with hardness) and an acoustical scheme depending upon a relationship between hardness and density (9a-58, Sept. 1948). Portable testers (12d-6, June 1948) are under continual development for convenience and special-purpose use.

Microhardness testing, while primarily a research tool for determining the hardness of metallographic constituents, is gaining more widespread use for the study of thin layers such as electrodeposits, foils, depth of hardened surfaces, and extent of diffusion. This technique requires the utmost care in surface preparation (9a-70, Oct. 1948; 9a-81, Nov. 1948). A work-hardened surface layer will affect the results obtained and it is usually advisable to remove this layer by electropolishing or etching before testing.

The Vickers diamond pyramid or the Knoop indenter may be used. Advocates of the former claim that its shape allows the use of heavier loads and its impression is more easily observed (9a-57, Sept. 1948). On the other hand, the long diagonal of the Knoop indenter minimizes any elastic recovery of the impression when the load is removed. High readings obtained under very light loads in these tests are variously ascribed to impression recovery, a worked surface layer, or imperfections in the tip form of the indenter. Daniels and Dunn (4c-69, Nov. 1948) studied the pronounced effects of grain orientation on variations in Knoop hardness measurements for noncubic materials. Undoubtedly, more such studies will appear in the future.

Hot hardness investigations have been found useful for preliminary investigations of TTT-curves for steel and the martensite point in cooling (9b-37, Sept. 1948). Results of such tests were corroborated by the usual metallographic methods. At present the limitations of this use appear to be dependent upon the maximum operating temperature of 1100° F. and the speed of taking successive readings—about one every 6 to 15 sec.

Hardness conversion charts, famil-

* The literature references are cited by the corresponding item number in the Review of Current Metal Literature instead of repeating the entire title, author, and source; this information can be obtained by referring to *Metals Review* for the month indicated.

iar for many years, may be revised by the American Society for Testing Materials in conjunction with the American Society for Metals and the Society of Automotive Engineers, for materials which have similar properties—several charts instead of one. Gray (9a-43, Aug. 1948) discusses some of the difficulties inherent in translating hardness values from one testing method to another. Variations in strain hardening, indenter geometry and penetration, and elastic moduli affect the measurements made on softer materials to a greater extent than on the harder materials such as heat treated steel.

Hardenability

Two outstanding developments in the field of hardenability during this decade have been the concept of multiplying factors devised by Grossmann and since modified and corrected by various workers, and the end-quenched hardenability test of Jominy and Boegehold for medium-hardening steels. Based on the Jominy test, the American Iron and Steel Institute together with the Society of Automotive Engineers four years ago established tentative "H-band" hardenability specifications. By this method, users are able to purchase steels of specified hardenability limits in lieu of ordering to required chemical analyses.

Ruhnke (3b-35, April 1948; 12b-82, Jan. 1949) states that a majority of customers buying "H-band" steels feel that they are securing better hardenability control. These specifications allow the producer a somewhat greater chemistry latitude in order to secure proper hardenability by last-minute additions based on melt analysis. Proponents claim that these specifications have eliminated extremes in hardenability occasionally associated with heats ordered to chemical analysis only (12b-70, Dec. 1948). Their use also often gives the desired results at lower cost (18b-73, June 1948). However, many users feel that the tentative hardenability band should be narrower. The suggestion has also been made (12b-37, July 1948) that it might be desirable to temper Jominy test bars, inasmuch as that is generally the commercial practice after quenching.

Recent Jominy tests indicate that cast steels comparable to wrought steels in analysis and grain size have similar hardenabilities (3b-112, Sept. 1948). Jominy tests have also been used on deep hardening steels by maintaining the top of the bar at a fixed elevated temperature during end-quenching (9b-54, Nov. 1948). While providing an adequate basis for a hardenability comparison between steels, the end-quench test does not indicate that steels with equal hardenability necessarily have equivalent structures in the slack-quenched zone. Troiano (9-23, Feb. 1949), studying steels of equivalent hardenability which had decidedly dissimilar chemistry, found that their structures at corresponding positions on the test bars were widely different.

Creep

The measurement of plastic yielding over a long period of time in a stressed material is known as creep testing. Tests wherein the specimen is broken are known as creep-rupture or stress-rupture tests. Creep testing equipment is being adapted for use at ever-higher temperatures, and 2100° F. is not uncommon today (9a-46, Aug. 1948). Modern testing units have facilities for the introduction of corrosive atmospheres, such as might occur in gas-turbines, or for atmospheric evacuation when materials are subject to heavy oxidation at test temperatures.

Although creep tests are generally made on specimens subject to static tensile stresses, new equipment has been designed to test behavior under static bending or torsion and fluctuating tension and torsion (9a-33, June 1948). Creep occurring during vibration, such as might be found in gas-turbine blading, may deserve further study. Creep tests, because of their long-time nature (recent rupture tests have been run longer than 6½ years), tie up equipment. Consequently, larger units are continually being constructed. Recently, a rupture-testing furnace was built to make 48 simultaneous tests (9a-13, March 1948). Electric strain gages can be used for measuring and continuously recording creep at temperatures up to 1800° F. (9a-102, Jan. 1949).

While it is not yet possible to predict the creep behavior of materials on the basis of known or easily measurable properties, Nowick and Machlin (3A-3, Feb. 1949), by applying dislocation and rate-process theories, derived an equation for the steady-state rate of creep which agrees with data on pure, annealed metals. However, much more needs to be known before the behavior of new alloys can be predicted. Glen (3b-28, March 1948) has attempted to isolate and determine the effect of variables such as heat treatment, deformation, and chemical elements on the creep properties of various molybdenum steels. Further light may be shed on these problems by a newly developed machine which provides an X-ray study of structure simultaneously with the creep test (9a-48, Aug. 1948).

Fatigue

Minute cracks formed in a metal during repeated cyclic stressing are the focuses of high stresses which may propagate the cracks until fracturing results. Such fractures, occurring at stresses below the tensile strength of the metal, are known as fatigue failures and account for most of the breakdowns of machine parts. The effect of design on fatigue life is of great importance. The presence of "stress raisers" such as keyways, splines, threads, and sharp fillets, decreases fatigue life, while shot-peening and smooth surface finish tend to increase it. The fatigue strength of bolts has been improved four to ten times by rolling the head fillet and threads after heat treatment (9-183, Jan. 1948), while thread grinding lowers the fatigue life. The deleterious effects on fatigue strength of hydrogen embrittlement during plating can be minimized to a limited extent by baking after, or nitriding before, plating (8-178, Jan. 1948).

A new hypothesis of fatigue fracturing has been developed by deriving expressions relating the brittle transition temperature of a material to the number of prior fatigue cycles (9b-15, April 1948). These indicate that the brittle transition temperature probably increases with a larger number of prior cycles until it reaches the temperature of the fatigue test and fracture results. The authors tentatively conclude that strain hardening and aging during stress cycling are responsible for the shift in the transition temperature.

Based on the work of Glocker, who noted that fatigue stressing apparently lowers surface stresses, the National Bureau of Standards is endeavoring to correlate the progress of fatigue damage with surface strain measurements by X-ray methods (24a-241, Jan. 1949). The extreme surface layers where fatigue cracks originate are apparently damaged by abrasion (4a-37, Sept. 1948). This phenomenon may be a factor in the poor fatigue strength of bolts having ground threads.

An alleged quantitative correlation between fatigue and creep has been developed by Machlin (3a-10, March 1948). Tests again substantiate the well-known fact that notch sensitivity in fatigue is a quite different property from notch sensitivity with single loading (9b-46, Oct. 1948).

The possibility of predicting the fatigue life of components in actual service appears brighter. Using magnetic testing equipment on fatigue specimens, failure could be predicted within 100,000 cycles in certain instances (24b-71, Aug. 1948). Many new fatigue testing machines capable of application to full-size components are being built. Use of such a machine by General Motors led to design changes in a connecting rod which increased the cyclic life fivefold at double the stress (9a-5, February, 1948).

Notched-Bar Testing

Notched-bar testing is a method by which a quantitative toughness value, though only for a given notch and a given specimen size, may be

secured under a certain set of stress conditions. Its data are subject to limited interpretation and have no relation to the shock loading of unnotched parts. Caution must be observed in evaluating these results. However, such tests when properly used may be valuable—more so to the metallurgist than to the designer.

Failures of welded merchant vessels have instigated numerous investigations of the cleavage or brittle fracture of ship plate. Although it has long been known that larger-size sections have a tendency to fail in brittle fracture, the convenience of the small-size Charpy impact tests led to an investigation of their suitability in determining the fracture behavior of ship plate. Such tests, however, are not entirely reliable for evaluating the acceptability of ship-plate steel because the transition temperature between ductile and brittle fractures varies with the section size.

Other methods for acceptance have been studied (9-22, Feb. 1949; 9b-17, April, 1948; 9b-12, April, 1948; 9b-4, March 1948). Klier, Wagner, and Gensamer favor a notation of the contraction of width at the fractured ege of a Schnadt-type specimen as a measure of quality. Another investigation showed that, as the severity of the notch used in Charpy-type tests increases, the transition temperature between brittle and ductile fractures also increases. A shift of 170° C. was noted for the range investigated.

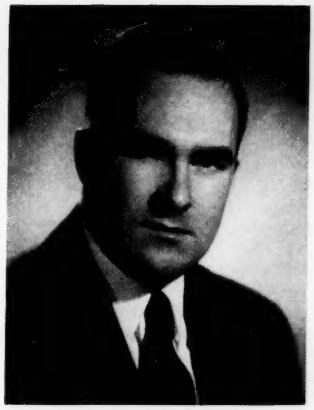
Impact

Tension-impact testing at higher velocities of impact may be useful in determining prior fatigue damage to service parts, according to Hoppman (9-2, Feb. 1949). Specimens previously subjected to fatigue stressing exhibited reductions in energy absorbed up to 30%. He does not believe that work hardening during fatigue cycling is responsible for such a reduction in energy absorption, but points out the necessity for further work to substantiate his conclusions. White and Griffis (3-407, Jan. 1948), point out that at higher velocities the specimen undergoes less deformation before fracture and, consequently, absorbs less energy.

Warnock and Pope (3-381, Jan. 1948) have reported that increasing the velocity of impact raises the impact yield strength, while repeated impact lowers the impact yield strength; this property varies greatly in any given material. The falling-tup impact test, which they used, is suitable for impact-fatigue tests.

Use of guillotine-type impact testers on the production-line inspection of small weldments more than doubled the quality of the assemblies during the first three months of use. (9b-36, Sept. 1948)

Projectile impact tests have been used to determine dynamic yield



John T. Stacy holds a degree in metallurgical engineering from Rensselaer Polytechnic Institute. Prior to joining the Battelle staff in 1946, he did research work with the War Department and the Navy.

stresses and changes in microstructure after impact of various materials (9a-92, Dec. 1948). Such tests provide a suitable means of obtaining very high compressive stresses for short periods of time. The dynamic compressive yield strength of a material was found to be much higher than its static compressive yield strength.

Ductility

Ductility is evaluated from the reduction of area and elongation of a tensile specimen, from a bend test, or from a cupping test such as the Erichsen test for sheet metals. These tests are useful in production and acceptance inspection for revealing irregularities in prior treatment, surface finish, and homogeneity. However, ductility is an elusive property linked to toughness, notch sensitivity, impact behavior, and the concept of the "transition temperature" where fracture characteristics change from ductile to brittle with decreasing temperature.

Roop (3-406, Jan. 1948) points out that this behavior occurs over a zone characterized by position and width, rather than at a particular temperature. Kinzel (22b-168, July 1948) used notched bend-test specimens for determining the level of this embrittling temperature in welded steel plates. Notched bend-test specimens, welded or unwelded, were also used by Stout and McGeady (9b-30, July 1948), Welter (22b-223, Aug. 1948), and many others in evaluating the transition temperature. Much of this work has been in connection with service failures in welded merchant vessels. These ships, designed with sufficient strength and made of steel with high ductility on the conventional tests, apparently failed through inadequate notch ductility. Roop indicates the need for a satisfactory ductility test and proper application of the data so obtained to the design of welded structures (24b-77, Sept. 1948).

Gaging

Mechanical, optical, pneumatic, and electrical gaging methods are constantly modified for greater accuracy, speed, convenience, or for new applications. X-ray gaging has entered the field of thickness measurement with recent developments by Westinghouse and General Electric. Used in strip mills, these instruments continually measure the gage of steel, copper, or other metals as it issues from the rolls. The Westinghouse gage is designed primarily for cold roll stands to measure materials from 0.005 to ½ in. thick. It is sensitive to 1% variations, and operates by comparison of standard sheet specimens and the rolled metal (12a-16, March 1948; 12a-47, May 1948). The General Electric gage, principally adapted for hot rolling mills, does not require a standard specimen and has been successfully operated on sheet at 1600° F. (11-114 and 12b-31, June, 1948). It is simple to operate, instantaneous in action, and able to discard faulty stock or to control mechanisms.

Electric resistance strain gages are a valuable tool in analyzing stresses in large structures. Strain gages attached to a large Hortonsphere indicated that certain sections were stressed at more than 2½ times the value predicted by simple theory (24a-150, July 1948). As many as 116 strain gages have been used on a 30,000-gal. storage tank (24a-99, May 1948). Logically, the electrical resistance of these gages should vary with the temperature of testing, but recent work has shown that, for 13 types, the variation from the room-temperature calibration factor for the range −73 to +93° C. did not exceed 4% (24a-27, March 1948).

Pneumatic and electro-pneumatic gages are not new (some foreign patents date back to 1928) but they are proving speedy and useful for measuring bores, very small holes, and automatic sizing devices on machine tools. Oldsmobile automatically gages cylinder bores, pistons, bearings and bushings while simultaneously classifying them for selective assembly (12b-72, Dec., 1948). With an air-gaging ring, 2400 piston pins per hour may be checked and segregated by size.

Nondestructive Testing

The determination of flaws in metals by nondestructive test procedures may roughly be divided into seven basic categories: radiographic, magnetic, ultrasonic, electrical, fluorescent, light, and thermal systems.

Location of pinholes in thin sheet or foil is an example of the use of light. Thermal methods are based on heat flow. They give qualitative results, but present many disadvantages associated with the use of waxes and heat sources. The field of nondestructive testing was surveyed extensively by Jackson, Banta, McMaster, and Nordin in relation to the testing of drill pipe (12b-29, June 1948).

Radiography

The field of X-ray radiography has been characterized by the development and use of higher-energy X-ray sources to yield greater penetrating power and the improvement of film and screens to secure sharper definition. With the two-million-volt machine, production inspection becomes feasible on steel 10 in. thick, while quantitative examinations have become practicable on sections up to 14 in. (12-1, Feb. 1949). Because of the practically point-source origin of these X-rays, and because the scattering factor has been reduced by the high energy radiation, sensitivity and definition are much greater. A two-million-volt X-ray machine was recently set up to examine the welding on large pressure vessels. Tanks 70 x 13 ft. in dimensions with 6-in. walls were radiographed with a sensitivity of 2% (12b-41, July 1948).

In 1938, Steenbeck initiated the first effective steps in ultraspeed radiography. Today radiographs can be taken through 1 in. of steel in one-millionth of a second (12a-23, April 1948). Applications are in the study of valve and piston motion, the flow of particles in metallic conduits, the propagation of explosion waves.

The development of a mobile unit for transporting an X-ray tube within a pipe bore now permits radiographing the entire circumference of a pipe weld in the field. The wet fim can be examined on the spot and some 20 joints can be inspected per day.

Microradiography uses an extremely fine-grained film to study the structures of thin sections of metals enlarged a few hundred diameters. Betteridge and Sharpe (11-65, May 1948), studying manganese sulphide segregations in steels, found that most of the normal alloying elements in steel can be selectively identified by suitable radiation; in general, nonmetallics cannot. Graphite, microsegregation, and microporosity in gray cast iron have also been studied by this method (11-90, June 1948).

Gamma-ray or radium radiography is advantageous where portability and simplicity are desired. It is generally less sensitive and more time consuming than X-ray inspection. Gamma-ray inspection costs from 60 to 75% as much as X-ray radiography, is less suitable than X-rays for critical flaw inspection in sections less than 1 in. thick, and requires great interpretative skill on the part of the inspector (12b-22, May 1948). Lauderbaugh and Brosky (12b-84, Jan. 1949) figure the cost of radium radiography of a welded pipe line at about $5 per weld inspected.

Preliminary experiments have been made in the use of radioactive isotopes for the radiography of steel in thicknesses up to 5 in. (12a-39, May 1948). For short-time usage these isotopes may become cheaper than X-ray or radium as a source of penetrating radiation. Already they have become useful as tracers in testing for wear, corrosion, cleaning, lubrication, the removal of oxygen and sulphur in steelmaking, and to determine the level of the melt in a cupola furnace (11-210, Oct. 1948; 11-243, Nov. 1948).

Magnetic and Electrical Methods

A recent installation for the high-speed continuous inspection of pistons includes equipment for automatically magnetizing, spraying with fluorescent compound liquid, and demagnetizing in one operation (12b-73, Dec. 1948). The quality of the test has been improved, while costs have been halved.

The use of magnetic particle testing on plated articles for the investigation of flaws in the base metal is risky. With a silver plate thicker than 0.0015 in., McBride found that all discontinuities in the base metal were not indicated by the magnetic particles (12b-34, June 1948). Smooth phenolic resin coatings also caused instability in the particle pattern. Such findings indicate that the inspection of coated or plated steel by the magnetic particle method should be preceded by a thorough investigation of the sensitivity attainable for the conditions of test. Roda (12a-84 and 12b-48, Sept. 1948) listed many of the magnetic particle inspection standards used in the aircraft industry.

Magnetic analysis, based on measurements of wave-form distortion, is used to determine surface flaws in bar and tubing stock. The Sclerograph, operating on magnetic and ultrasonic principles, predicts failures in oil-field drilling equipment (12b-30, June 1948). Magnetic testing devices such as the Cyclograph that depend upon comparisons of high-frequency core losses are useful in the rapid inspection or sorting of small parts.

Tests based on conduction of electric current can be used to determine the thickness of metallic walls accessible from only one side, such as boiler tubes and ship plates. This test, however, is not applicable to severely scaled surfaces. It may be useful for determining the depth of surface flaws when combined with magnaflux tests (12b-59, Nov. 1948).

Electrical tests offer possibilities in the inspection of non-magnetic metals. Three such tests are a magneto-electric method employing an exciter and search coil, a potential-difference type, and an induced-current system in which a light-alloy billet is rotated in a magnetic field wherein pulses of the induced current indicate defects (12a-74, Aug. 1948). None of these methods is as good as the magnetic fluid tests performed on magnetic materials.

Ultrasonics

While other applications are possible, flaw detection and gage measurement are the chief uses of ultrasonic instruments. Typical defects in forged turbine disks not detectable by radiographic examination can be located by ultrasonics (9a-59, Sept. 1948). However, in weld inspection at least, all the larger defects indicated by fast ultrasonic scanning should be checked with radiographic examination to determine the size and nature of the flaws (12b-76, Jan. 1949). A newly developed "angle beam" technique has been introduced for the inspection of welds. The transmitter can be placed in the parent metal adjacent to or within several inches of the weld (12a-67, July 1948).

Ultrasonics offer a promising method of production inspection for the detection of laminations in sheet metals (12-5, Feb. 1949). Application of this method to the testing of high-strength propeller steel both at the fabricating plant and at the steel mill has cut rejections. It has also eliminated the necessity of performing expensive operations before judging the quality of the steel (12b-21, May, 1948).

Inspection

The proper application of testing methods to insure the quality of the product is of vital importance to manufacturers. Statistical methods to improve the quality of output and to better inspection procedures are used in steel mills, foundries, fabricating plants, small-parts concerns, and others.

Statistical inspection sampling plans based on probability involve a calculated risk. The risk-level is determined in advance and adjusted to bring a balance between inspection costs and substandard material costs which will result in over-all economy. This method is especially adaptable to the inspection of lot material. Such a system reduced the defective workmanship expense account in a screw machine department by 28% while simultaneously reducing the inspection personnel by 60% (12a-14, March 1948). Similarly, a ball bearing division cut defective production as much as 85% (12b-85, Jan. 1949). Certainly these records—only two among many—speak eloquently for statistical inspection methods as a means to cut costs and improve quality.

IMPORTANT MEETINGS
for June

June 2-4 — Electric Metal Makers Guild, Inc. 17th Annual Meeting, Bismarck Hotel, Chicago. (D. L. Clark, secretary, E.M.M.G., Box 6026 Mt. Washington Station, Pittsburgh 11.)

June 9-11—Armour Research Foundation in cooperation with Physics Department of Illinois Institute of Technology. Symposium on Fine Particles and Resolution, Stevens Hotel, Chicago. (Four sessions, instrument displays and photographic exhibit. W. C. McCrone or C. F. Tufts, co-chairmen, Armour Research Foundation, Illinois Institute of Technology, 35 West 33rd St., Chicago 16.)

June 13-15—American Society of Mechanical Engineers. 15th National Applied Mechanics Div. Conference, University of Michigan, Ann Arbor.

June 20-24—American Society for Engineering Education. 1949 Convention, Rensselaer Polytechnic Institute, Troy, N. Y. (C. J. Freund, president, A.S.E.E., dean of engineering, University of Detroit, Detroit, Mich.)

June 27-30—American Electroplaters' Society. 36th Annual Convention, Schroeder Hotel, Milwaukee. (A. R. Putnam, A.E.S., 473 York Rd., Jenkintown, Pa.)

June 27-30—American Society of Mechanical Engineers. 1949 Semi-Annual Meeting, San Francisco. (Ernest Hartford, executive assistant secretary, A.S.M.E., 29 West 39th St., New York 18.)

June 27-July 1—American Society for Testing Materials. 52nd Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. (R. J. Painter, A.S.T.M., 1916 Race St., Philadelphia 3.)

Cuts Ribbon on New Plant

The cutting apart of a steel ribbon with "CutTrode" cutting electrode featured the opening ceremonies of the newly acquired plant of Eutectic Welding Alloys Corp. in Flushing, N. Y.

The new plant occupies approximately 100,000 sq. ft. and houses a foundry, metal rolling and drawing plant, several large extrusion presses for producing coated electrodes, a complete gas welding division, plus special research laboratories.

Birdsong Dies Suddenly, Was Ten-Year Secretary

J. H. Birdsong, long-time secretary of the Buffalo Chapter A.S.M., died suddenly on April 7. Mr. Birdsong was vice-president of Buffalo Testing Laboratories, a firm of analytical and consulting chemists and metallurgists.

Active in the Buffalo Chapter A.S.M. since 1927, Mr. Birdsong has seen that group grow from a membership of 50 to about 280. He is a past chairman of the chapter and was honored at the National Metal Congress in 1947 for having served ten years as its secretary.

A graduate of North Carolina State College, he joined the Carnegie Steel Co. in 1903 as assistant chief chemist. Later he was associated with the National Malleable and Steel Castings Co., Chicago Works. In 1927 he moved to Buffalo as chief chemist and metallurgist for Pratt & Letchworth Co., and in 1932 joined the Buffalo Testing Laboratories.

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J. A. Hutchinson, a quarter-century member of the New Haven Chapter, died on April 23.

The Reviewing Stand

LITERATURE RESEARCH apparently is not a matter of concern solely to the scientist in the laboratory, but is also of vital importance to the business tycoon who juggles the financial balance sheets and the production wizard who superintends the practical problems of plant operation. At least, such is the implication of an editorial column headed "The Production Pattern" in a recent issue of *Business Week*. To quote:

"Researching the background of a new product or process is a tedious job. It takes plenty of detective work. Engineers have to scrounge in libraries and other sources for what's called 'the previous state of the art.'

"That work is important: It helps avoid patent infringement; it flushes out promising leads for design or process improvement; it gives the engineer a storehouse of information that has been laboriously put together by previous researchers.

"But moneywise and timewise it costs plenty to do the job right. And if your company is small, you might be handicapped."

The editorial goes on to give some very useful information concerning the facilities for literature searches of one of the well-equipped technical libraries. Without any disparagement of the indispensable services rendered by such libraries, *Business Week* might also have done well to mention the equally valuable help offered by the abstracing services maintained by various technical societies in their respective fields of science and engineering—such a service, for example, as that provided by A.S.M.'s own *Review of Current Metal Literature*.

These services, by searching hundreds and thousands of periodicals, books, and other published material for all of the information in their field—by abstracting, classifying, indexing, and by providing information on sources and locations of original material—vastly simplify the "detective work" required of the researcher. With such time-saving records readily available at almost negligible cost, the small businessman can oftentimes do his own detective work in a most efficient and economical manner.

Prevention of Deterioration

"Prevention of Deterioration Abstracts" is the title of another new and useful abstracting service referred to in this column last December. Unfortunately, our information at that time was either incomplete or inadequately presented, for we are now in receipt of the following communication from the Prevention of Deterioration Center of the National Research Council in Washington, D. C.:

"The Prevention of Deterioration Abstracts provide current information concerning the causes and prevention of deterioration of materials, components, and assemblies. Since the deterioration of metals is an economic factor responsible for billions of dollars of annual damage, and, therefore, of relatively great concern to many research institutions, the 'Metals' section in our abstracts is quite large. We emphasize, however, that we do not cover all aspects of the field of metals, but restrict our thoroughly planned survey to the specific phases relating to deterioration.

"Abstracts, in general, constitute an efficient means by which men of science keep informed of progress in a special field without spending considerable time or money in searching the vast quantities of original literature. This type of specialized service could hardly be furnished by any business unit at the quoted rate; fortunately, the Prevention of Deterioration Center is a nonprofit organization, though not a government agency." M.R.H.

Shows How Bainitic Hardening Improves Impact Strength Without Hardness Loss

Reported by H. H. Benninger
Peninsular Steel Co.

March 14 was the date of the annually celebrated "Sustaining Members Night" of the Detroit Chapter A.S.M. The appreciation of the Chapter was extended to the 68 sustaining members by Chairman Art Smith, and certificates were presented those organizations which have maintained membership for five successive years.

The highlight of the evening was reached when Morris Cohen, professor of metallurgy at Massachusetts Institute of Technology spoke on "Heat Treatment of High Speed Steels". His lecture covered his recent observations on carbide solution and bainitic transformation in high speed.

Dr. Cohen demonstrated how impact properties are adversely affected by increasing the quench temperature and thereby increasing the carbide solution. Annealing to machinable structures can be readily accomplished by low-temperature carbide solution and isothermal transformation not far below the critical range.

Knowledge of the TTT-curves has pointed the way to a new process known as bainitic hardening. This process is carried out by interrupting the cooling of the steel, either on quenching or from the draw, at a predetermined temperature. While all of the observations on this material are not complete, it is apparent that impact strength can be improved without loss in hardness or other desirable properties.

A discussion of professional football as viewed from the press box was presented by Lou Zarza, end coach of the Detroit Lions, immediately prior to Dr. Cohen's lecture.

Morris Cohen at Detroit

J. H. G. Monypenny Dies, Was Stainless Authority

John Henry Gill Monypenny, who died on March 2 at Sheffield, England, was a world authority on stainless steels, the first edition of his book on this subject having been published in 1926.

Mr. Monypenny was born in 1885 and studied at University College in Sheffield, which awarded him an associateship in metallurgy. For more than 40 years—until his retirement in 1946—he was instrumental in the development of the research departments of Brown Bayley's Steel Works, Ltd., where he conducted his research work on the stainless steels.

Recipient of many honors in his own country, he was also a member of various American technical societies, including the A.S.M. As British correspondent for *Metal Progress* in the late 30's he sent many interesting contributions to that publication.

Metallurgist Occupies an Important Position in Steel Plant, Says Reinartz

Reported by W. P. Wallace
University of California

The important role of the metallurgist in a steel plant was made apparent in a talk before the Los Angeles Chapter A.S.M. on Feb. 18. The audience learned why Armco represents quality steel when L. F. Reinartz, manager, Hamilton and Middletown Division of Armco Steel Corp., spoke on "Steelmaking Practice".

The blending of raw materials for the blast furnace, the mixing of the hot metal prior to the openhearth process, the segregation of scrap, examination of slag samples, temperature observations during the heating and rolling operations, close temper control in strip annealing—these and many other operations are supervised by metallurgists. Also, prior to acceptance of orders from a new customer, a metallurgist visits his plant and works out with his engineers the specifications which assure the proper quality required for the specific purpose. Such quality control from raw materials to the finished article results, according to the speaker, in less than 1% breakage in many customers' plants.

The automotive industry over a long period of years, more than any other industry, has led the way for the manufacture of quality steel, the speaker pointed out. To reach this goal, the steel plants had to introduce quality control from beginning to end. Other new developments in blast furnace and openhearth practice instituted at the Armco plants have resulted not only in better steel, but also higher production.

At the end of his talk, the speaker answered many questions. Joe Wilson acted as technical chairman.

Founders' Day Celebrated

Reported by Robert T. Hook
Assistant Metallurgist
Warner & Swasey Co.

March 7th was the occasion for the Cleveland Chapter A.S.M. to honor its founders with a dinner for the representatives of each company. Chairman Stewart Grant introduced each representative, and gave the date his firm joined the Cleveland Chapter. He then expressed the thanks of the chapter for the support these firms have contributed.

As the speaker of the evening, Blake Crider, professor of psychology at Fenn College, talked about the "Effects of Psychology in Everyday Living". Dr. Crider confined his talk to the problems of the normal mind and went to great length to show that many of the mental hygiene problems among today's adults are readily traced to childhood.

Krivobok Speaks on Stainless

A Lively Meeting on Stainless Steels Was Held by the Baltimore Chapter A.S.M. in February. V. N. Krivobok (right) of International Nickel Co. was the speaker. Center is A. L. Feild, technical chairman, and at left is Howard Sittler, meetings chairman

Variety Is Spice of Western Metal Congress

Reported by Ernest E. Thum
Editor, Metal Progress

Kathy Fiscus fell into a narrow well; an earthquake jarred the northwest coast; Wallace Beery died—all these competed for attention, yet no less than 25,000 manufacturers, engineers, department heads, and metal purchasers attended the Western Metal Congress and Exposition in Los Angeles the week of April 11. Shrine Convention Hall is a cavernous structure, but space had to be rationed in order that the 211 firms participating could each have room to exhibit. Without detracting from the general excellence of the booths from the viewpoint of eye appeal, it may be said that the outstanding feature was undoubtedly *variety*—no matter what the metallurgical interest of the visitor was, he was able to find something to answer his inquiry either in the exhibit hall or in the 34 technical sessions held by the American Society for Metals and the cooperating societies.

Part of the Crowd of Some 25,000 Plant Operators and Engineers Who Attended the Western Metal Exposition Last Month in Los Angeles

California's well-advertised climate and old-age pension plan may obscure the fact that, in ten years, the West Coast has become less a health resort than an important manufacturing region. Plant visitations to near-by Vernon, where an entire community of important factories has been erected since the war—to Alhambra, Torrance, Riverside, Fontana—impress the idea that a healthy variety of industry now supports and supplements the aircraft manufacturing that centers in the Los Angeles-San Diego region. Eighty firms with California addresses, catering to metal manufacturing, exhibited in this Western Metal Exposition. Men from all eleven of the Rocky Mountain and Pacific states attended.

Facts such as these warrant a resolution by the Board of Trustees of the American Society for Metals that technical sessions and exhibitions will be held under the Society's auspices every two years on the Pacific Coast. Secretary Eisenman has already announced that the 1951 meeting will be in the San Francisco Bay area.

As in all annual meetings of the American Society for Metals, no effort was made to attract the general public. In fact, admission was restricted to members of the 17 technical societies which have formal organizations in Southern California, and to technical and engineering persons holding invitation cards from the exhibitors. The Exposition was conspicuously devoid of movie stars, jazz bands, and other stimulators dear to high-pressure publicity. Its one purpose was to present valuable manufacturing information to men who knew what to do with it. Judging from comments overheard in the audience and freely expressed by the exhibitors, this aim was most successfully achieved.

The Los Angeles show can be regarded as a "western edition" of the 30-year-old National Metal Congress and Exposition. However, the firms adapt their exhibits to the time and the audience, as naturally would be expected. At the national exposition in an eastern center, the general effort seems to emphasize fabrication, heat treatment and finishing processes, while in the western show more stress is laid on materials and products for the various consuming plants and industries.

In the planning of the technical program, inspection trips, ladies' entertainment, and numerous other details, several local committees ably cooperated in representing the five main cooperating societies. These were the American Society for Metals, American Welding Society, American Institute of Mining & Metallurgical Engineers, American Foundrymen's Society, and Society for Non-Destructive Testing.

In the presentation of 82 papers, simultaneous sessions were avoided by each society, but obviously the seeker after knowledge had his choice of from two to four meetings on any morning or afternoon. The American Welding Society had the most extensive program, next to the A.S.M.'s, and featured a number of panel discussions wherein an array of experts, chairmanned by a moderator of distinction, tossed the ball in the air, and then let the audience bat it back and forth at will. These free-for-alls proved highly popular and most of them had to be interrupted by the dinner bell.

The A.S.M. program consisted of four educational lectures on "Metallography", and 30 technical papers chosen after a poll of local members had indicated desirable topics. Most of these will be published either in *Metal Progress* or in *Transactions*. Symposiums were held on corrosion, on oxidation resistant metals, and on metals for ultra-high temperature.

In "Stainless Steels for Special Services", V. N. Krivobok of International Nickel's development and research department described recent variations in the 18-8 family designed to counteract two deficiencies of the more-or-less standard analysis—namely the deterioration of mechanical properties at medium temperatures, and the impaired resistance to certain corrosive solutions. In the first instance, the offending element carbon can now be easily reduced by very low amounts (0.02%), but other elements—such as nitrogen—must then be given close attention. In the latter instance, Dr. Krivobok called attention to the beneficial effect of copper as an addition to 18-8 in non-oxidizing environments.

Perhaps the largest audience heard the symposium on metals for ultra-high temperature. Roger Long described alloys for jet engines—the ones used in superchargers during the last war, and the improved varieties in present gas turbines. He said the ideal was turbine blades and vanes to operate at 3000° F., no less. The next speaker, Earl R. Parker, of University of California, emphasized how little is really known at present about the mechanical properties of the truly refractory metals and their alloys such as tungsten, molybdenum, zirconium. Following Professor Parker's talk, Walter J. Koshuba outlined the metallurgical requirements anticipated for an atomic engine to drive a B-36 bomber. Here the nuclear properties of the metals are equally as important as their mechanical strength and physico-chemical stability, and here again the area of ignorance is enormous.

Metals Review's Honor Roll of the Well Informed

The following readers returned correct answers to the quiz page in the March issue of Metals Review. To earn a place on this honor roll, turn to page 4 and test your own knowledge of current events in the metal industry.

Tryggve Angel, metallographer, Avesta Iron & Steel Works, Sweden.

Dale Bittinger, assistant superintendent, sheet mill, Jessop Steel Co.; Earl J. Bleakley, assistant metallurgist, Jeffrey Mfg. Co.; G. W. Boyd, associate professor, Michigan College of Mining and Technology; W. W. Brenneman, metallurgical inspector, Lima-Hamilton Corp.; Wm. Bruce, toolmaker, McCord Corp.; Felix H. Brysacz, metallurgist, Park Drop Forge Co.; G. F. Bush, research engineer, Eclipse Counterbore.

John L. Cahill, welding engineer, New York Naval Shipyard; Hallock C. Campbell, associate director of research and engineering, Arcos Corp.; Robert W. Campbell, metallurgical engineer, Metal Treating Institute; Ralph R. Casper, heat treater, Eastman Kodak Co.; E. J. Casselman, research engineer, Eversharp Inc.; Keith A. Charters, salesman, Harrington Tool & Die Co. Ltd.; R. Ernest Christin, chief metallurgist, Columbus Bolt & Forging Co.

Gerard J. Davidse, metallurgist, Allegheny Ludlum Steel Corp.; Gerrit DeVries, metallurgist, U. S. Naval Proving Ground; Joseph F. DiVito, metallurgist, David Bradley Manufacturing Works; Harold A. Dorfman, powder metallurgist, NEPA Division, Fairchild E. & A. Co.

Simon Feigenbaum, research engineer, Jones & Laughlin Steel Corp.; George L. Flint, assistant department head, metallurgical department, Carbide & Carbon Chemical Co.; James L. Foster, metallurgist, Goodyear Aircraft Corp.; Ray Fritz, metallurgist, Hotpoint Inc.

Robert M. Gontz, metallurgical engineer, Titan Metal Mfg. Co.; Russell K. Grant, heat treater, General American Transportation Co.

E. A. Hall, heat treat foreman, Schwitzer-Cummins Co.; Glenn R. Haller, heat treater, National Screw and Mfg. Co. of California; S. J. Hayes, mechanical superintendent, Bureau of Mines, Ottawa; D. C. Heckard, metallurgical assistant, Armco Research Laboratories; P. S. Hoffman, metallurgist, Treadwell Engineering Co.; Henry C. Holbert, finishing supervisor, Easy Washing Machine Corp.; Frank H. Holmes, Lt. Col. USAF, Munitions Board.

H. Richard Irwin, metallurgical engineer, Babcock & Wilcox Tube Co.

Walter C. Kahn, Jr., assistant technical director, New York Testing Laboratories; D. A. Kassner, Senior Student, Pratt Institute; Aaron J. Keeperman, Senior Student, Pratt Institute; Anthony Klinshaw, hammerman, Worthington Pump & Machinery Co.; Raymond B. Koehler, materials engineer, Office, Chief of Ordnance, Department of the Army; Philip A. Koerner, metallurgist, Beech Aircraft Corp.; Alfred S. Kos, consulting engineer, Cleveland.

E. F. Lackman, metallurgist, Republic Steel Corp.; Paul J. Landgraf, student, Case Institute of Technology; Bert R. Lanker, chief metallurgist, Farrell-Cheek Steel Co.; Val Lazar, metallurgist, Philadelphia Naval Shipyard; John C. Lehmann, heat treat tool expert, Kaiser-Frazer; K. E. Luger, partner, K. E. Luger Co.; Robert St. Clair Low, powder metallurgist, Baker & Co., Inc.

Donald R. Malthaner, Senior Student, University of Notre Dame; James H. Marshall, metallurgist, Seeger Refrigerator Co.; Donald E. Matthieu, assistant to superintendent, Southern Wheel Div., American Brake Shoe Co.; Robert P. J. McCarty, president, Robert P. J. McCarty & Sons Co., Inc.; Hudson T. Morton, standards engineer, Fafnir Bearing Co. Inc.; R. H. Myers, assistant chief metallurgist, Willys Overland.

E. L. Novomesky, metallurgist, Wright Aeronautical Corp.; F. S. Nussbaum, assistant metallurgist, National Malleable and Steel Castings Co.

Charles H. Parcells, metallurgical tech. I; International Harvester Co.; Alfred Pasler, heat treater, A. Hoffman & Co.; R. Y. Peterson, metallurgical engineer, General Electric Co.; David W. Pettigrew, Jr., research engineer, Aluminum Research Laboratories.

John Roberts, works metallurgist, Darlington Forge Ltd., Darlington, England; Harry F. Ross, research engineer, Battelle Memorial Institute.

Leonard J. Sadowski, metallurgist, Kirk-Wiklund & Co.; Richard D. Schoch, sales engineer, Ladish Co.; P. E. Shannon, reports editor, Bureau of Mines, Ottawa; R. E. Sheffer, assistant works manager, Aluminum Co. of America; G. H. Silver, metallurgist, Monarch Machine Tool Co.; A. P. Simpson, owner, Simpson Motor; Rebecca H. Smith, chief metallurgist, Turbodyne Corp.; M. W. Stevens, metallurgist, General Electric Co.; Stewart J. Stockett, research engineer, Battelle Memorial Institute; W. P. Strader, sales engineer, Duriron Co., Inc.

R. C. A. Thurston, metallurgist, Bureau of Mines, Canada.

Greswold Van Dyke, metallurgist, H. & B. American Machine Co.

Joseph J. Warga, metallurgical standards engineer, Sperry Gyroscope Co.; Russell C. Weymier, trainee, Inland Steel Co.; Dean N. Williams, student, Michigan College of Mining and Technology; William Wilson, Jr., research metallurgist, Armour Research Foundation; Paul M. Winslow, metallurgist, Solar Aircraft Co.; Carl J. Wirth, metallurgist, Terre Haute Malleable & Mfg. Corp.; Urs Wyss, engineer, Louis von Roll Iron Works, Gerlafingen, Switzerland.

Francis G. Young, property accountant, Consolidated Western Steel Corp.

Turn to page 4 for this month's quiz

Wear Resistance Accounts For Many Unusual Uses Of Cemented Carbides

Reported by O. G. Saunders
Chief Metallurgist, Hobart Mfg. Co.

Generally, when sintered or cemented carbides are mentioned, we are apt to limit our thinking to the familiar carbide tips on cutting tools. While these tips do represent the bulk of carbide consumption, there are many other unusual uses such as thread guides for the textile industry, nozzles for metering powdered soaps into their containers, and also other applications where high wear resistance is desired. Carbide dies, particularly for silicon sheet steel, are coming into prominence.

William Bleecker, chief metallurgist of the Carbide Alloy Division of Allegheny-Ludlum Steel Corp., assisted by Paul Rehner, chief die engineer, and F. C. Shields, gave a most interesting evening to the Dayton Chapter A.S.M., directing their remarks to information concerning the metallurgy, manufacturing, and application of "Carmet", the tungsten carbide made by Allegheny-Ludlum.

Mr. Bleecker told of the unusual properties of tungsten carbide. Its high hot hardness and abrasion resistance are familiar to most, but the material is also capable of very high compressive strength (approximately 900,000 psi.) and high rigidity (modulus of elasticity of 89,500,000 psi.).

Starting with tungstic acid, Mr. Bleecker traced the various operations, including reduction, carburizing, milling with cobalt, compressing, presintering and sintering. After compressing and presintering, the tungsten carbide has enough strength so that it can be handled, cut and shaped with diamond abrasive wheels. It is at this time that the intricate shapes of die parts and other special pieces are formed. Size at this time is so calculated that after the final sintering, in which the parts shrink considerably, the resulting piece will have a minimum of grinding stock.

There are a number of grades of tungsten carbides, each having properties specially suited for particular applications. This is accomplished by varying the amount of cobalt and also by introducing other carbides, such as those of titanium and tantalum.

25-Year Members Honored

Six of the Most Recent Additions to Pittsburgh Chapter's Roster of Quarter-Century Club Members Were Honored Guests at the March 11 Meeting. Left to right, they are: E. S. Taylerson, Carnegie-Illinois Steel Corp.; F. H. Allison, Jr., United Engineering & Foundry Co.; C. E. Carlson, Aluminum Co. of America; C. E. Corson, Edgewater Steel Co.; E. H. Dix, Aluminum Co. of America; and C. E. Loos, Carnegie-Illinois Steel Corp.

Metals, Welding Groups Hear GE Engineer

Officials of the Local Groups of A.S.M. and A. W. S. at a Recent Joint Meeting in Warren, Ohio, Are (From Left): J. J. Riley of Taylor-Winfield Co., A. W. S. Secretary-Treasurer; I. A. Oehler of the American Welding and Mfg. Co., A. W. S. Chairman; George Richardson of General Electric Co., Guest Speaker; D. G. Schaffert of Copperweld Steel Co., A. S. M. Chairman; R. E. Goodman, American Welding and Mfg. Co., Vice-Chairman

Reported by E. W. Husemann
Metallurgist, Copperweld Steel Co.

More than 100 technical representatives of area manufacturing plants—one of the largest groups ever to attend a joint meeting of the Warren Chapter A.S.M. and the American Welding Society, Mahoning Valley Section—heard George Richardson, welding engineer for General Electric Co., River Works, on Jan. 20.

Mr. Richardson spoke on the welding and fabrication of the aircraft gas turbine or jet engine. A colored film entitled "Jet Propulsion," prepared especially for General Electric by the Walt Disney studios, was shown. Slide views of all principal types of U. S. Air Force jet aircraft were also described. Richardson emphasized the important part played in jet engine construction by the various welding processes.

D. G. Schaffert, assistant superintendent of the melt shop, Copperweld Steel Co., and chairman of the Warren Chapter A.S.M. presented "recognition of service" certificates to E. W. Husemann, metallurgical department, Copperweld Steel Co., and I. A. Oehler, director of metallurgy and research, American Welding and Manufacturing Co., for their services as past chairmen of A.S.M. Dr. Oehler, who is also currently chairman of the local welding society group, introduced the guest speaker.

Gas Evolution in Solidifying Castings Causes Porosity

Reported by W. G. Fassnacht
Assistant Chief Metallurgist
Bendix Products Division

"Gas porosity in castings is almost always caused by gas evolution within the solidifying mass, with mechanical entrapment of air or mold gases a less frequent reason." So said L. W. Eastwood, supervising metallurgist of Battelle Memorial Institute, when he addressed the Notre Dame Chapter on the subject of "Porosity in Castings".

Gas evolution results from two causes: (*a*) the reduced solubility of a gas such as hydrogen when the melt temperature decreases and solidification occurs, and (*b*) the reaction of hydrogen or carbon with oxygen or oxides in solution in the melt to form steam or CO bubbles.

In copper and iron-base melts, there is a definite relationship between the oxygen content and the presence of reducing alloy elements or impurities, on the one hand, and the oxygen and hydrogen contents on the other. The lower the content of reducing elements, the higher the oxygen content and the lower the possible hydrogen, and vice versa. Consequently, copper-base alloys are best melted under oxidizing conditions, then deoxidized just before pouring to prevent high hydrogen or oxygen contents in the liquid metal.

As little as 0.000002% hydrogen by weight can cause 1% voids in a copper-base alloy casting. Aluminum and magnesium alloys are not amenable to this type of degassing treatment and, therefore, are degassed just before pouring by such methods as chlorine or nitrogen fluxing.

Two types of voids are formed by gas evolution, pinholes or gas holes, and microporosity; the latter is most common in solid-solution type alloys.

Gas dissolved in the liquid metal originates from the melting environment, from contact with air during pouring, and from mold gases. Successful production of gas-free castings depends upon proper control of all three sources of gas and upon the efficacy of degassing treatments.

THIRTY YEARS AGO

After a short life as independent organizations, the Steel Treating Research Society and the American Steel Treaters Society merged in 1920 to form the present American Society for Metals. The early issues of the official publications of these two societies (1917-1920) are filled with nostalgic and historical associations.—Ed.

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Leading article in an early issue of the *Proceedings* sounds a still-familiar refrain: "The time has come," says the author, "when the designing engineer of machine parts and the metallurgical engineer must cooperate together." (Readers of the current pages of *Metals Review* will recognize the same admonition frequently repeated before A.S.M. chapters.)

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The title of this article is "Wearing Qualities of Gears Made From Various Metals and Their Heat Treatment"; its author W. H. PHILLIPS, then metallurgist for R. D. Nuttall Co. Mr. Phillips, whose sudden death in October 1947 shocked many old friends, is best remembered as vice-president in charge of sales for Molybdenum Corp. of America, and as A. S. M. national president in 1933-34.

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The same issue carries an announcement of a contest to pick a name for a new department in the magazine. The page was to carry short items or hints of a practical nature, and a $50 Liberty Bond was offered as a prize for the best name. "Kinks", "Hardening Cracks", "Fire and Water" were some of the suggestions, but "Critical Points" proved to be the winning selection. The reincarnation of "Critical Points" in the pages of *Metal Progress* in 1939 is entirely coincidental, says Editor Thum.

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Listed as a new patron member of the society is Vanadium-Alloys Steel Co., Latrobe, Pa. ROY C. MCKENNA, now president of the company and still an active member of the Pittsburgh Chapter, is listed as representative on the membership.

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The Scleroscope method of hardness testing was enjoying wide popularity—so much so that two questions submitted by ROBERT HADFIELD of London were considered worthy of 13 pages of published reply by A. F. SHORE of Shore Scleroscope Co. The questions concerned the newer method's relationship to Brinell hardness numbers.

Flamatic Control System Guarantees Uniformity

Reported by Knox A. Powell
Research Engineer
Minneapolis-Moline Co.

The principal feature of the Flamatic heat treating equipment is its electronic temperature control system, it was shown in an illustrated talk presented jointly by D. M. Strauchen and Milton Garvin before the North West Chapter A.S.M. on March 17. Mr. Strauchen is manager of the machinery division, and Mr. Garvin manager of the Flamatic division of the Cincinnati Milling Machine Co.

They showed how a highly sensitive thermopile is focused to receive radiant energy from the rotating workpiece during the heating cycle. The emf. generated thereby is transmitted to a temperature recording and controlling intrument. When the surface of the part reaches the desired preset temperature, the flames are extinguished, the spindle stops, and the part is deposited in the quenching medium.

This new control system guarantees that each part, in any lot, is the exact counterpart, metallurgically, of any of the others in the same lot.

The Flamatic machine uses oxy-acetylene or oxy-propane, and the flame is conveniently adjustable. Available heat output of the flames greatly exceeds the thermal conductivity of material being heated. This allows for adjustment of heat input to a point slightly exceeding the ability of the material to absorb it. A uniform martensitic structure is produced, with a uniform gradient in the body of the workpiece, thereby eliminating the ferrite band commonly appearing in the transition zone.

Cincinnati believes the use of some alloy is preferable in order to take advantage of the oil quench, thereby lessening the possibility of distortion and cracking. Quench is by drop delivery into an oil bath.

Illustrations showed how heat can be driven into surfaces of a shape or position which would be difficult or impossible by any other method. Flamatic heat input, it was pointed out, is not affected by the magnetic changes which take place between Ac_1 and Ac_3.

At the March Meeting of the North West Chapter in Minneapolis Are (Left to Right): D. M. Strauchen of Cincinnati Milling Machine Co., One of the Speakers; Robert Lundquist, Chapter Chairman; Milton Garvin, Manager of the Flamatic Division of Cincinnati; and Al Ridinger, Vice-Chairman

Terre Haute Hears Rieppel

Reported by M. E. Hansell
Rose Polytechnic Institute

P. J. Rieppel of Battelle Memorial Institute addressed the Terre Haute Chapter A.S.M. on April 4 on "Welding Metallurgy". He paid particular attention to hydrogen embrittlement, pointing out causes and cures, or at least ways to ease the bad effects.

Arthur Lindholm, a local manufacturing jeweler, also gave a talk on the lost-wax method of casting.

Direct-Reading Spectrograph Gives Pushbutton Chemistry

Reported by Robert S. Spalding
Engineer, Aircraft Mechanics, Inc.

Quantitative analysis by the direct-reading spectrograph or Quantometer was characterized as "pushbutton chemistry" by William E. Davis, general sales manager for Applied Research Laboratories, before the Rocky Mountain Chapter A.S.M. Mr. Davis spoke on "Spectrochemical Analysis of Metals".

In using the Quantometer, the operator places a cleaned sample in its holder on the instrument, pushes a button, and then reads the analysis about 20 sec. later. An alloy can be analyzed for as many as 20 different elements at the same time.

Construction of the machine is similar to that of an ordinary diffraction grating spectrograph through to the focal plane. At this location, for each element being analyzed, a small mirror catches the light of the desired spectral line and reflects it into a photomultiplier tube. The electric current thus set up is amplified and conveyed to a metering device where the concentration of the element sought can be read from a tape. An integral part of the Quantometer is the source unit which gives a standardized voltage and time to the spark.

Applied Research Laboratories also makes a unit which will convert an ordinary spectrograph into a recording type. In this unit the amplified signals from the phototubes charge condensors, which, in turn, actuate recording pens.

With the conversion unit, a sample may be analyzed for ten elements in about a minute and a half. The quantometer gives an analysis in a third of a minute or about a thousand analyses a day.

Mr. Davis pointed out that the accuracy of the spectrograph, especially on lower concentrations, is as good as that of most chemical analyses, the error being proportional to the amount of the particular element present in the alloy, and not to the total amount of metal being analyzed.

Among other uses where a spectrograph has possible advantages over the ordinary chemical means are analyses of scrap, slag, dust, competitors' products, welding rod coatings, electroplatings, segregations in metal, atmosphere, water and oil. The liquids are sparked with the aid of a spinning graphite disc.

It is not yet possible to test quantitatively for carbon or sulphur with the spectrograph, but experiments pointing toward this end are being carried on. Possible solutions may be the cyanogen or carbon monoxide lines, or the infrared end of the spectrum.

Mr. Davis concluded his talk with slides of spectrographic instruments and data, and a short movie of the Quantometer in operation.

Shows Progress Made in Forming of Sheet Steel

Reported by Henry J. Frontroth
Raymond Mfg. Co.

Cold forming and deep drawing of sheet steel formed the subject of a talk given by R. S. Burns, associate director of research, Armco Steel Corp., to the Northwestern Pennsylvania Chapter A.S.M. at a meeting held at Corry, Pa. on March 31.

Slides showed the progress made in deep stamping over the past 12 years. Stress-strain diagrams, showing the effect of heat treating and aging on mild and killed steel sheets, were discussed, while micros showed the structure as related to breakage and stretch of sheet steel.

30-Month Research On Chromium Plating Reveals New Data

Reported by W. K. Fossett
Process Engineer, Beech Aircraft Corp.

Research work on chromium plating conducted for some 30 months under the auspices of the Wichita University Foundation for Industrial Research was described before a record - breaking attendance of the Wichita Chapter A.S.M. Lloyd McKinley, head of Wichita University's department of chemistry, who conducted the research program for Beech Aircraft Corp. during the war, was the speaker; the title of his talk was "Electrodeposition of Chromium to Tolerance".

L. McKinley

After reviewing the history of chromium plating as revealed in the literature, Dr. McKinley called attention to the amount of litigation that has occurred with the chromium plating patents. Many diverse authoritative theories exist as to the role of current density, temperature, bath composition, agitation, and anode material and area, with respect to the cathode area, as a function of the chromium deposit's appearance, hardness and coverage.

Considerable emphasis was given in the research to the problem of deposit coverage or throwing power. There being no satisfactory method of measuring this helpful but elusive characteristic, a new apparatus and technique were employed which gave consistent results. Briefly, the method consisted of immersing an open-sided methacrylate plastic box, havreceptacles for maintaining the correct positioning of the perforated anode and the two cathodes and a pump for circulation, in a larger chromium plating bath carefully controlled as to temperature, current density, and composition. With this arrangement, throwing powers of 40% were achieved.

Although consideration was given to materials other than chromic acid and to solvents other than water, none were found to be satisfactory. A patent extolling the virtues of chromic chloride in ethylene diamine was fruitlessly exhausted.

No new understanding was gained as to the function of the sulphate ion in chromium plating, the research merely concurring with the thought that the sulfate ion acts as a catalyst.

Dr. McKinley described difficulties in obtaining reliable hardness data with the Tukon hardness tester. To achieve concordant results, steel panels of extreme flatness had to be employed, covered with a minimum of 0.001 in. of plating.

Dr. McKinley concluded by summarizing various relationships bebetween current density, temperature, hardness and chromic acid concentration. At any one temperature there is either a certain current density or a range of current densities for which hardness of the deposited chromium is a maximum. At 25° C., for instance, the maximum hardness is obtained at 0.25 amp. per sq. in. with a concentration of 53 oz. of chromic acid per gal. The deposit is satin-like and has a Knoop hardness number in excess of 1800. No other set of conditions as to temperature, current density and CrO_3 concentration has rivaled this deposit in hardness and appearance.

Film on Rail Steel Offered

A new motion picture entitled "Rail Steel in the World of Today" has recently been completed by Campus Film Productions, Brooklyn, N. Y., for the Rail Steel Bar Association. The film shows heating, slitting and rolling of rail steel products, fabrication, photomicrographs, animated stress-strain charts, and a section devoted to the new "high-bond deformations" in reinforcing bars.

It is in 16-mm. color and sound, runs 34 min., and is narrated by Lowell Thomas. The film is available to engineering groups and colleges on a free-loan basis. Ten days to two weeks notice is required. Applications should be addressed to the Rail Steel Bar Association, 38 South Dearborn St., Chicago 3, Ill.

A Powder Metal Huddle on Particle Size

This Group in the Mineral Industries Art Gallery of Pennsylvania State College Is Deep in a Discussion of Particle Size and the Effects of Particle Size Distribution. Left to right are: R. W. Ricker, research assistant in ceramics, Penn State College; M. F. Judkins of Firth Sterling Steel Corp., the speaker; J. H. Keeler, chapter chairman; H. J. Read, acting chief of the division of metallurgy at Penn State; H. M. Davis, associate professor of metallurgy; J. E. Fair, vice-chairman; and C. C. Wright, chief of the division of fuel technology at Penn State

Reported by F. R. Lorenz
Pennsylvania State College

Malcolm F. Judkins, chief engineer, Carbide Division, Firth Sterling Steel and Carbide Corp., spoke at a recent monthly meeting of the Penn State Chapter A.S.M. Following the chapter's custom, Mr. Judkins met with an undergraduate group in the afternoon, at which time an informal discussion was held on metallurgical practice and opportunities in his plant. The evening session was devoted to a lecture entitled "Powder Metallurgy—the Manufacture of Carbides, Their Nature, Properties and Uses".

Mr. Judkins briefly traced the development of powder metallurgy from its birth, in attempts made 100 years ago to make platinum laboratory ware, to the present-day uses. The unusual properties developed in powder metallurgical products were aptly demonstrated by reference to the hardness of tungsten carbides. This hardness is an inherent property, is not developed through heat treatment or working, and results in a stress-free material.

The speaker described sintering practices and gave a few illustrations of the use of sintered metals for gage blocks possessing great dimensional stability, for self-lubricating bearings, and in many special types of alloys.

The question-discussion period following the meeting was longer than the talk itself, an indication of interest in a rapidly expanding field.

Subject Is Mechanical Testing

Arthur E. Focke (left), A.S.M. National Vice-President and Chief Metallurgist of Diamond Chain Co., Indianapolis, Discussed Mechanical Testing From Both the Practical and Theoretical Standpoints Before the St. Louis Chapter on Jan. 21. Dr. Focke used the repetitive method of teaching to put over the important points of his lecture. Next to Dr. Focke, in succession, are Ed St. Eve, chapter chairman; George Rohlfing of Aluminum Ore Co., coffee speaker: and L. Malpoker, program chairman. (Reported by H. O. Nordquist)

Many Criteria Used in Evaluating Projects for Industrial Research

Reported by Milo J. Stutzman
Midwest Research Institute

Industrial research has grown about three-fold in the past ten years, according to Edward Hartshorne, assistant director of research and development, Western Cartridge Co. and Winchester Repeating Arms Co. (divisions of Olin Industries, Inc.). Large sums of money are being appropriated to industrial research yearly and management has the right to know how the money is spent and the value received by the industrial organizations appropriating it.

Mr. Hartshorne discussed the management of industrial research as practiced by Olin Industries, before the Kansas City Chapter A.S.M. A large number of problems come to the research and development division from various sources, and only a limited number can be studied. Thus, careful screening of ideas is necessary before work is started on a project.

The purpose of a research project at Olin Industries must fall into one or more of seven categories, largely having to do with improving quality and developing new products, processes and uses. An idea that fits one of the seven categories must then meet four criteria which determine whether it will work in with the corporation's facilities and equipment.

Ideas that have successfully passed these screening tests have to pass four more tests before they attain the stature of a project. These have to do with commercial and technical evaluation, patent situation and capital investment. Other divisions such as sales and production are consulted for their suggestions before the program is presented with a budget request to the board of directors.

The idea has now become an active project. When the laboratory and pilot plant work is completed (assuming that the project has successful conclusions commercially), a "technical proposal" is submitted to the works manager of the factory. The proposal gives detailed manufacturing procedures, raw materials specifications, final product specifications, experimental data, patent protection, and an estimate of its commercial value. The works manager must reply to the proposal within a reasonable time and has only two choices: (*a*) to accept the proposal for trial, and (*b*) to reject the proposal for cause.

Finally an audit is made by the treasurer's department to determine an "index of return" for the project. The index of return, as used by Olin Industries, is calculated as follows:

1. For an improvement of a process, credit is given for the full amount of savings for one year.

2. For an improvement in an existing product, credit is given for 3% of the gross sales for one year.

3. For a new product, credit is given for 3% of gross sales for a period of three years.

It should be noted that the index of return is not in dollars, but in units. It has been found that this index is as much a measure of the ability of the production organization to take advantage of research results as it is a measure of the research and development division itself.

Common Sense Required As Necessary Ingredient Of Good Heat Treating

Reported by James M. Loiacono
Eclipse-Pioneer Div., Bendix Aviation Corp.

"Good heat treating practice is mostly a matter of common sense in the application of sound metallurgical principles," stated Howard E. Boyer, chief metallurgist of the American Bosch Corp., in a talk before the New Jersey Chapter A.S.M. Mr. Boyer's address was entitled "The Application of New Metallurgical Knowledge to the Practical Heat Treatment of Steel".

From a proper study and application of available time-temperature-transformation data, advantages can be gained in reduction of furnace time and in general improvement in processing, the speaker said.

Mr. Boyer also discussed cold treatment, distortion and growth, martempering, and induction heat treating. He advised the use of cold treatment only for those high-alloy steels which tend to retain large amounts of austenite after quenching (e.g. the high-carbon, high-chromium, die steels).

Mr. Boyer advocates a realistic approach to the problem of distortion and growth, since the very nature of heat treatment in steel involves increases in volume during the austenite - to - martensite transformation. The speaker's researches have led him to anticipate increases in dimensions of the order of 0.0015 in. per linear inch. Distortion is largely associated with the geometry of the piece. The use of comparatively expensive quenching dies often helps to minimize distortion tendencies of complicated steel parts.

The application of martempering was strongly recommended as an effective means of reducing distortion during the quenching of steel parts. Advantages of inductive heating methods for selective heat treatment of steel parts were also discussed.

$500 Prize Contest Announced

Washington Steel Corp. has announced a contest with $500 in prizes for suggestions for new uses of its MicroRold stainless steel sheet and strip in gages of 0.015 or thinner. The contest closes at midnight, June 30, 1949. Further details may be secured by writing to Contest Headquarters, Washington Steel Corp., Washington, Pa.

Patent Situation on Nodular Cast Iron Still Confused

Reported by J. C. Selby
Timken Roller Bearing Co.

The patent situation in the manufacture of nodular gray iron is still confused, C. O. Burgess pointed out in addressing the March meeting of the Canton-Massillon Chapter on "Methods of Production and Properties of Nodular Gray Iron". Mr. Burgess, who is technical director of the Gray Iron Founders' Society, Inc., was associated with the Union Carbide and Carbon Research Laboratories when the first heat of this ductile cast iron was produced in this country, and has since followed closely the progress made in its manufacture and application.

Mr. Burgess first discussed the different methods of production, including various shortcomings and hazards. The original British procedure used cerium, while the method developed in this country uses magnesium. Both the International Nickel Co. and the American Cast Iron Pipe Co. have been active in this latter development.

Possible reasons for the production of nodular rather than flake graphite were outlined. The limits of analysis of the cast iron and the various elements involved in the process were sketched, and finally the changes in physical properties to be expected were discussed in detail.

Since the material is still under development, no commercial applications have been made. However, Mr. Burgess cited a large number of potential applications.

The Gray Iron Founders' Society, in its capacity as trade association to the gray iron industry, is interested in facilitating both the rapid technical advance and the sound economic position of nodular iron.

The evening was concluded with a long and lively question period led by Past Chairman H. W. White.

Movies on Aluminum and Preparedness Talk Given

Reported by R. Carson Dalzell
Chief Technical Advisor
Revere Copper and Brass, Inc.

The technical part of the March meeting of the Rome Chapter A.S.M. consisted of two movies. One from Aluminum Co. of America, entitled "Curiosity Shop", is a good attempt to humanize industrial research and at the same time promote the uses and properties of aluminum. This was followed by Revere's movie on aluminum, which also features applied research.

Coffee speaker was Major R. A. Lepesqueur, Utica Unit instructor of the local district of the Organized Reserve. Speaking on "Integration of Military and Industrial Programs", he traced the development of preparedness programs from President Wilson's first Resources Board to the present activities under the National Security Act. Important aspects of the current program are stockpiling of raw materials *and* finished products, as well as training of industry.

Hear Croft on Copper

Wichita Chapter Was Host to A.S.M. Trustee Harry P. Croft at National Officers Night on March 15. Dr. Croft spoke on "Copper and Its Industrial Applications". In the picture, left to right, are: Wichita Vice-Chairman Phil Koerner of Beech Aircraft; Chairman Hank Wyckoff of Triplett and Barton, Inc.; Dr. Croft; and Treasurer Roscoe Howard, also of Beech Aircraft. (Reported by E. A. Bussard)

Special Furnaces and Generators for Controlled Atmospheres Described

Reported by John W. Sweet
Chief Metallurgist, Boeing Airplane Co.

The importance of research in relation to industrial atmospheres was emphasized by Norbert K. Koebel, director of research for the Lindberg Engineering Co., at the February meeting of the Puget Sound Chapter A.S.M. Mr. Koebel covered the history and development of controlled atmospheres from the blacksmith forge to the copper brazing of corrosion resistant steels.

Initial attempts along this line were made to control scaling in open-fired furnaces by proper adjustment of air-fuel ratio. With the advent of the muffle type furnaces the demand for an atmosphere which would neither scale, carburize nor decarburize during heat treatment stimulated research which resulted in the development of present-day controlled atmosphere generators. Inert gases such as nitrogen or hydrogen were among the first to be tried but infiltration resulted in decarburizing atmospheres. Straight natural gas carburized the parts, and this proved to be as bad as decarburization. Partially combusted gases were found to be satisfactory for relatively low-carbon steels.

Two Types of Generators

Two modern atmosphere generators for use in heat treatment of steels are the charcoal generator and the endothermic generator. The charcoal generator is simple, and is ideal as to low initial cost or occasional operation. The cost of gas generation is relatively high. A small amount of propane added at the generator neutralizes the effect of the 0.5% CO_2 generated. A special charcoal low in moisture content has been developed for use with this generator.

The endothermic generator cracks a mixture of air and hydrocarbon gas into CO, H_2 and N_2. By careful control of air-gas ratio and high-temperature cracking, the CO_2 can be eliminated and the dew point of the generated gas controlled. With this type of equipment a gas can be generated and maintained in equilibrium with steel of any carbon content.

The gas generated by the endothermic method may be used as a carrier for carburizing and dry cyaniding. A new high-speed furnace has the preheat and high-heat furnaces integrated. The work is shoved from one zone to the other and quenched in a water-jacketed atmosphere chamber without exposure to air, thus eliminating all scale.

Another research project involves the use of hydrogen for the bright copper brazing of stainless steels. A special sealed furnace with purging chambers at each end was developed for this project.

Two Hardening Methods Explained

Holding the Chicago Chapter Bell Between Them Are (Left) M. M. Garvin of Cincinnati Milling Machine Co., and (Right) H. B. Osborn of Ohio Crankshaft Co., Joint Speakers at Midwestern Chapter Night. Flanking them are (left) L. E. Simon, vice-chairman of the Chicago Chapter, and (right) M. J. Day, chairman. (Photo by M. J. Vandenberg)

Reported by C. L. Lindgren
Metallurgist, Acme Steel Co.

"Selective Methods of Surface Hardening" was the topic when Midwestern Chapter Night was celebrated at the March meeting of the Chicago Chapter A.S.M. A number of members of neighboring chapters were attracted by the caliber of the speakers, Dr. H. B. Osborn, Jr., technical director of the Tocco Division of Ohio Crankshaft Co., and M. M. Garvin of the Cincinnati Milling Machine Co.

Dr. Osborn traced the development of induction heating from its inception some 47 years ago to the present motor-generator, spark-gap and vacuum-tube oscillating units now employed. Explaining that the principle of induction heating is, in effect, similar to that of a simple transformer, with a primary source inducing current into a secondary, he emphasized the fact that a definite correlation exists between the size of the stock being heated and the frequencies employed. Greater concentration of heat at the surface is gained by the use of higher frequencies; however, the power introduced plays an important part, for in the use of induction heating prior to forging low power density is employed.

Mr. Garvin, who is manager of Cincinnati's Flamatic hardening machine division, explained in some detail the principle of operation of the Flamatic machine. This equipment is described in the report on page 14 of this issue.

Both Mr. Garvin and Dr. Osborn illustrated their talks with slides showing installations and adaptations of their respective methods of heating applications.

Ajax Moves to New Plant

The Ajax Electric Co., Inc., Philadelphia, has moved its manufacturing facilities for Ajax-Hultgren salt bath furnaces to a new plant at Tioga & Melville St., Philadelphia. The Ajax business office is still located at Frankford and Delaware Ave., Philadelphia.

Self-Sufficiency in Raw Materials a Vital Problem

Reported by J. G. Cutton
Metallurgist, Carnegie-Illinois Steel Corp.

Achieving some degree of self-sufficiency of vital natural resoures depleted by two world wars in the United States and in other countries is a serious problem to steel producers, Charles M. Parker told the Mahoning Valley Chapter on Feb. 8 in Youngstown. Mr. Parker, who is secretary of the Committee on Manufacturing Problems of the American Iron and Steel Institute, spoke on "Self-Sufficiency Vs. World Trade in Raw Materials".

World trade in natural resources is dependent upon expediting the discovery of new sources of supply, the speaker continued. Research is needed in the field of hard-to-get resources with the idea of beneficiating low-grade reserves and substitution of more available metals. One example is the manganese situation—48% of the manganese ore used in the United States in 1948 was imported from Russia, and only 2% was found in this country.

In the discussion Mr. Parker indicated briefly what elements might be substituted, partially, for manganese in constructional steels. Molybdenum and titanium are possible emergency substitutes in limited fields. Recovery of manganese from openhearth slags was also discussed.

Furnace Brazing Speeds Production And Reduces Cost

Reported by R. S. Haverberg
AC Spark Plug Div., G. M. C.

Since its advent in 1907—first used in 1912 to braze the tungsten buttons on contact arms for automotive ignition systems — furnace brazing has received wide acclaim and is now used extensively on a great variety of manufactured goods, according to H. M. Webber, engineer in the industrial heating division of the General Electric Co. Mr. Webber described the applications and problems of furnace brazing before the Saginaw Valley Chapter A.S.M. on Feb. 15.

Most copper brazing applications have speeded up production and reduced cost by major savings in machining time and materials, the speaker continued. Complicated forged and machined assemblies have been reduced in size and weight.

The most common furnace brazing metals in use today are copper, brass, phosphor-copper alloys, and silver brazing alloys. Copper as a brazing metal, using a reducing atmosphere of either hydrogen, dissociated ammonia or partially burned hydrocarbon gas, is used in almost 90% of all furnace brazing applications. Brass, because of the distillation and sublimation of zinc at the required melting temperature, is used in only a few isolated instances.

The phosphor-copper alloys are limited to use on nonferrous alloys, because of the embrittling effect of phosphorus on iron. The silver brazing alloys are used quite extensively, particularly in those applications where a high temperature is objectionable.

Expansion of parts in furnace brazing sometimes necessitates fastening to prevent slippage of joints. Typical methods used are staking, flaring and spot welding. Fixtures are to be avoided if possible, because they are expensive, short-lived, and sometimes weigh as much or more than the parts themselves, with resultant furnace inefficiency.

Brazing metals flow into joints by capillary action which is directly dependent on wetting ability. The class of fit between two members to be brazed is therefore important. The most common forms of brazing materials are wire, slugs, powder and foil. Copper plating and sprayed coatings are also used in limited applications.

Furnaces for copper brazing may be batch-type, continuous-belt, bell-type, and roller-hearth furnaces. Each type is specifically suited to copper brazing and designed to suit the quantity and size of work to be brazed.

Compliments

To NORMAN F. TISDALE, chief metallurgical engineer of Molybdenum Corp. of America since 1933 (past national trustee of A.S.M.), on his promotion to manager of sales.

♦ ♦ ♦

To HARRY K. IHRIG, vice-president and director of laboratories of Globe Steel Tubes Co., on the citation for distinguished service in engineering presented by University of Wisconsin.

♦ ♦ ♦

To R. B. MEARS, manager of the research laboratory of Carnegie-Illinois Steel Corp. on the receipt of the 1949 Willis Rodney Whitney Award of the National Association of Corrosion Engineers; also to F. L. LAQUE, in charge of the corrosion engineering section, International Nickel Co., Inc., on the receipt of the 1949 Frank Newman Speller Award of the N.A.C.E.

♦ ♦ ♦

To EDWARD L. RYERSON, chairman of the board of Inland Steel Co. and Joseph T. Ryerson & Son, on the citation presented in the "Look Applauds" section of the March 29th issue of the magazine *Look*.

♦ ♦ ♦

To GOLDYE COHEN on being the first woman to receive the degree of Bachelor of Metallurgical Engineering from the Polytechnic Institute of Brooklyn.

♦ ♦ ♦

To EDWARD H. SNYDER, president of Combined Metals Reduction Co., Salt Lake City, Utah, on his election as president of the American Zinc Institute.

Travelers

DONALD L. COLWELL, sales engineer of the Apex Smelting Co., has returned from abroad. He and Albert Butler of Denver were sent to six European countries by the Economic Cooperation Administration to examine the aluminum requirements of Europe—a step to help alleviate the tightness in aluminum supplies.

♦ ♦ ♦

PROF. GREGORY J. COMSTOCK, director of research of the Powder Metallurgy Laboratory at Stevens Institute of Technology, left on April 5 for a month's stay in England, Germany and Austria, on a commission for the Bureau of Ships of the U. S. Navy Department. Purpose of the visit is to discuss parallel research projects with British governmental agencies.

Economist Recommends Wise Use of Metals Rather Than Hoarding

Reported by Howes Bodfish
Aluminum Co. of America

The wise use of metals rather than hoarding is the key to the thinking of the Metals Economics Branch of the U. S. Bureau of Mines, Charles White Merrill, chief of that branch, told the March meeting of the Baltimore Chapter A.S.M.

Metallurgists can help the conservation program best by making use of metals which are in large domestic supply or found in accessible, friendly territory, he said. Examination of specifications for presently popular alloys is suggested.

Manganese is a good example of a metallic raw material involving national insecurity. We produce only 10% of current requirements. We import 34% from Russia and 56% from distant sources subject to serious difficulties of transportation and defense. Stockpiling when surpluses are available, conservation in use, and substitution of alloying materials in good domestic supply are clearly indicated. While the stockpile of manganese is increasing, the quantity required for a major war is huge.

Tin is also a strategic problem. Substantially all must be imported and we get only low-grade ore from Bolivia, which is our only large western hemisphere source.

Present exploration in Labrador and Quebec for an iron ore source to replace the depleted Mesabi mines should have an effect on our economy. The existence of a large and continuing flow of scrap was noted.

Copper, formerly exported, is now imported in large quantities. No nation, however, with an annual mine production of 800,000 tons can be called a "have-not" nation, as has been loosely stated by some speakers and writers.

Antimony could be greatly affected by the movement of the Communist armies. While the producing properties are in South China, the possibility of future aggression may not be neglected.

Aluminum, influenced greatly by its price pattern with respect to other metals, is now in demand in quantities far above prewar levels. Further growth is restricted by lack of available power.

Inspect Piston Ring Foundry

A Group of Baltimore Chapter Members Surveys the Centrifugal Molding of Piston Ring Pots at Koppers Co., Piston Ring Division, at the March Meeting. Following the inspection tour C. W. Merrill of the U. S. Bureau of Mines lectured on "Raw Metallic Sources"

Bryant Heater Purchased

The assets and business of the Bryant Heater Co., Cleveland, have been purchased from Dresser Industries by Affiliated Gas Equipment, Inc., and the firm will henceforth be known as Bryant Industrial Division of that company. The manufacture and sale of all former Bryant Heater products, using the same trade names, will be continued with no change in personnel.

Gives Sand Testing Course

The Harry W. Dietert Co. of Detroit is sponsoring a sand testing school consisting of a three-day session each month. The object is to teach the technique and theory of sand control as it relates to casting quality and quantity.

There is no charge for this course. Those enrolling in the school are invited to bring casting defect problems along for discussion.

Three Aspects of Corrosion Discussed

Reported by J. J. Buczynski
Metallurgical Department
Taylor Instrument Companies

Three aspects of the general problem of corrosion were discussed in detail by Frank L. LaQue of International Nickel Co., Inc., before the Rochester Chapter A.S.M.

In the first part of the talk he described the effects of small amounts of alloying elements on resistance of steel to atmospheric corrosion. The alloying elements considered were copper, nickel, chromium and phosphorus. Rusts have certain protective characteristics, he pointed out, and differences in environment will affect the opportunities for formation of protective rusts.

Accelerated laboratory tests are likely to be unreliable for comparing different steels, and the speaker suggested that the color of the rust that develops during the early stages of exposure would provide a better basis of predicting the relative merits of steels. The darker the rust, the less will be the atmospheric corrosion of steel.

The second portion of the talk was devoted to some of the principles of galvanic corrosion. The importance of the relative areas of anode and cathode was illustrated by examples of favorable relationships involving a small cathode and large anode and of unfavorable circumstances involving a small anode and large cathode. The benefits of partial, as well as complete electrical insulation were mentioned. Dangers exist in trying to take care of galvanic effects by the use of protective paint coatings, and the speaker admonished the audience to put the paint on the cathode rather than on the anode—or, better still, paint both the anode and cathode.

The final portion of the talk was concerned with relations between stress and corrosion. Stress effects vary in the ranges of elastic and plastic deformation; the effect of plastic deformation on the potential of a corroding metal is much greater than of elastic deformation. In elastic deformation, stress ordinarily has an insignificant effect as compared with other factors on over-all corrosion or on the potential between stressed and unstressed metal. The higher potential of plastically strained metal seems to play a major role in the progression of corrosion fatigue cracks.

In stress-corrosion cracking an environment damaging to one class of material has no similar effect on another class. Except in a general way, it is impossible to predict reliably without preliminary tests whether or not a corrosive medium will cause stress-corrosion cracking of any particular material. For some combinations of materials and environments there is a sort of threshold stress value below which no cracking will occur.

In general, it may be stated that for every known metal and alloy and even some organic plastics, there will be some combination of stress and specific corrosive medium in which stress-corrosion cracking will occur. The unsafe combinations must be established by research and practical experience. The remedies include control or elimination of stress or the choice of a more suitable material to withstand the effects of stress in the environment involved.

Shown Having a Short Chat After Mr. LaQue's Talk on "Corrosion of Metals" Before the Rochester Chapter Are (Left to Right): Rea Hahn, Program Chairman; Guido Palma, Chapter Chairman; Norman Finsterwalder, Secretary; and Frank LaQue of International Nickel Co., the Principal Speaker

Lustron House Described For Calumet's Ladies

Reported by John A. Rassenfoss
Research Metallurgist
American Steel Foundries

A record crowd of 190 attended the annual Ladies Night of the Calumet Chapter and heard E. E. Howe describe the many new and interesting features of the Lustron home. In addition to the regular program the ladies were entertained with music and each received a serving tray as a souvenir of the evening.

Mr. Howe, manager of the ceramic division of the Lustron Corp., stated that metal housing has combined the talents of the architect, metallurgist and the home economist to produce a new standard of living.

Porcelain-enameled steel forms the interior and exterior walls of the house. Durability, strength and color fastness are the important advantages, which lend eye appeal and lowered maintenance cost. A damp rag suffices to remove most dirt from the enameled surface, and savings in housecleaning time alone have been estimated at 50%. Another unusual feature of the house is the use of radiant heating from the ceiling.

Fabrication Costs for Stainless Steel Absorbed As Familiarity Is Gained

Reported by L. Wiley Cooper
Iowa State College

The reluctance of many designers and fabricators to adopt stainless steels simply because of the difference in fabrication techniques was pointed out by S. P. Odar, Republic Steel Corp. metallurgist, speaking before the Des Moines Chapter A.S.M. Mr. Odar presented an up-to-date talk on the types of stainless steels and their field of successful application.

After the initial changeover is made, he said, the costs of production will drop greatly as familiarity is gained with the process and as methods are developed that suit more closely the nature of the stainless steels. The experience of a large manufacturer of stainless steel railroad cars affords an excellent example. By successive improvements in details of production the company was able to reduce the man-hour units from 50 for each of the first five cars to eight units after the sixtieth car was built.

As a "coffee speaker" prior to the main technical paper, Prof. Phillip Riggs, head of the Drake University astronomy department, presented a film "Exploring Space" and a short discussion on the problems involved.

Casting Symposium Indicates Fields Of Three Methods

Reported by Earl C. Beatty
Chief Metallurgist, Tube Mill
Aluminum Co. of America

"Aluminum Die Castings", "Investment Casting" and "Modern Production Ferrous Casting" were the subjects treated in a Casting Symposium sponsored recently by the Purdue Chapter A.S.M. Principal speakers were James N. Smith, chief engineer, die casting division, Aluminum Co. of America; F. S. Badger, vice-president in charge of research and development, Haynes Stellite Co.; and A. W. Demmler, director of metallurgy and reseach, Campbell, Wyant and Cannon Foundry Co.

In the aluminum die-casting process, according to Mr. Smith, two types of machines are in common use today. Relatively high production rates are obtained with the cold-chamber (or high-pressure) machine on small castings, while the gooseneck machine is generally used for the larger sizes.

Sizes vary from a few ounces to 20 lb. and up to 7 ft. in length. Wall stock varies from 1/16 in. minimum on certain small castings (not over 6x6 in.) to 5/32 in. on large castings. A tolerance of ±0.0015 in. per in. for sections up to 10 in. long is obtainable, while a minimum tolerance of ±0.002 in. on any dimension plus additional tolerance across die parting lines is required.

Proper design influences both quality and cost of die castings. Utility of the product can be increased by inserting metal pins, lugs, cylinders, or bearings to produce a relatively inexpensive finished part that requires little, if any, machining.

Field for Precision Castings

Mr. Badger then reviewed the development of precision casting. This method is ideal for the production of a large number of small parts of high-temperature alloys that cannot normally be made by any other method. Mold preparation was illustrated with slides and exhibits.

The maximum size produced in precision casting is 10x10x5 in. The largest casting currently made weighs approximately 5 lb. and the smallest about 0.002 lb. The wall section can be as thin as 0.030 in. on a tapered section; otherwise 0.050 in. is the lower limit. Tolerances of approximately 0.005 in. per in. with a minimum of 0.003 in. per in. are maintained commercially.

Since the alloy cost is a relatively small percentage of the total cost of an investment casting, the use of high-alloy material does not appreciably increase the cost over low-carbon or alloy steel.

Mr. Demmler discussed the mass production of ferrous castings for automotive and other industries. Continuous melting is used instead of single heats. The molten iron is transferred from the cupola to a holding furnace at frequent intervals, and from this the desired quantity can be drawn off as required. For further refining to steel, metal may also be transferred to a bessemer converter and then to an electric furnace. Some alloying is subsequently done in the ladle to obtain the desired composition and structure.

The advantages of cast iron over forged steel for some automotive parts from the standpoint of economy and service life were illustrated by comparing the fatigue life and the number of processing operations required in automotive plants. In some instances fatigue life was over three times greater for cast iron than for forged steel.

Quality control of foundry work, as described by Mr. Demmler, consists of thoroughly checking the sand, cores and molds; X-ray examination of castings; numerous spectrographic and chemical analyses; mechanical property and metallographic tests; and thorough control of all casting operations.

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Close Control Provided by Induction Heat for Forging

Reported by Alexander Lesnewich
Rensselaer Polytechnic Institute

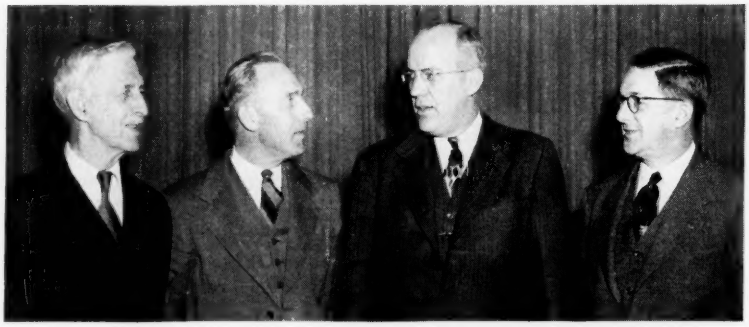
Increased die life, control, speed and flexibility in forging are some of the advantages of induction heating cited by Frank T. Chesnut, treasurer of the Ajax Electrothermic Corp. at the March 8th meeting of the Eastern New York Chapter A.S.M. Mr. Chesnut's topic was "Induction Heating With Special Reference to Heating for Forging".

After explaining the principle of induction heating the speaker reviewed some of its applications, which include melting, forging, brazing, heat treating, surface hardening, and high-temperature operations up to 3600° C. Mr. Chesnut also described the various types of induction equipment used for production heating and melting.

Numerous slides were used to show the advantages of induction heating for many forging applications. This method provides the close control necessary for heating billets uniformly and rapidly to any desired temperature gradient. In addition, because of the high efficiency, flexibility, speed of heating and adaptability to automatic operation provided, the process is inducive to greater production economy.

The chief of the Albany Weather Bureau, Ernest C. Johnson, outlined the functions of the United States Weather Service in his coffee talk.

Two Presidents at Officers' Night



Left to Right Are G. B. Waterhouse, Past President A.S.M., Who Acted as Coffee Speaker and Technical Chairman; Louis Geerts, Boston Chapter Chairman; President Harold K. Work, Principal Speaker; and Howard Handy, Chapter Secretary-Treasurer. (Photo by H. L. Phillips)

Reported by Morris Cohen
Massachusetts Institute of Technology

A large audience turned out for the March meeting of the Boston Chapter to welcome and listen to Harold K. Work, president of A.S.M., who addressed the chapter on "New Developments in Steelmaking". While Secretary Bill Eisenman was not on hand this year, Dr. Work had a round of stories that Bill would have found it hard to beat. Past-President George B. Waterhouse and Former Trustee John Chipman were also present to make up the complement of national officers.

After dinner, Dr. Waterhouse gave an engaging account of his recent trip to Colombia, South America, as metallurgical consultant to the Colombian Government. He described the geography, climate and industry of the country, and discussed the prospects for iron and steel production there. Then, Dr. Waterhouse slipped into the role of technical chairman and introduced Dr. Work as technical speaker of the evening.

Dr. Work brought greetings (and statistics) from the Cleveland headquarters, and then, in one of the highlights of the evening, he presented the society's Gold Medal to John Chipman in recognition of his valued services as national trustee.

In his technical talk, Dr. Work discussed the use of small scale equipment in steelmaking research. He also described the development and operation of an experimental openhearth furnace, and emphasized the role of nitrogen and deoxidation practice in the cold working behavior of steel.

Sustaining Members Honored

Certificates Were Presented to Honor Sustaining Members of the Mahoning Valley Chapter on March 8. Top row, left to right are: Clifford C. Horstman, Westinghouse Electric Corp.; H. C. Deichert, Lifetime Products Co.; J. F. Blaemire, Sr., J. F. Blaemire & Sons. Bottom row, left to right: John A. Ritz, Metal Carbides Corp.; David B. Carson, Jr., Falcon Bronze Corp.; Thomas E. Eagan, Cooper Bessemer Corp.; and Charles Schultz, Cold Metal Products Co. (Photo by Henry Holberson)

Reported by J. G. Cutton
Met., Carnegie-Illinois Steel Corp.

"Selection and Placement of Personnel Through Testing" was the subject of the Mahoning Valley Chapter's meeting on March 8. C. A. Service of the industrial relations department at Westinghouse Electric Corp.'s Sharon Plant was the speaker.

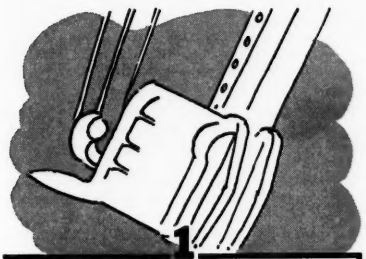
Mr. Service, the originator of the testing program at the Sharon Plant, has examined over 10,000 employees and prospective employees. Two tests are usually given, the first to measure mental ability and the second to rate personality and cooperativeness.

The prospective employee is then compared against an average of those now working on the job applied for, thus facilitating proper placement. Upgrading and job classification are also part of the test program. Many procedures are used to test for specific qualifications.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received During the Past Month

Prepared in the Library of Battelle Memorial Institute, Columbus, Ohio
Ralph H. Hopp, Librarian *W. W. Howell, Technical Abstractor*



ORE BENEFICIATION and RESERVES

1A—General

1A-18. Grundlegende und neuere Erkenntnisse bei der Feinmahlung von mineralischen Rohstoffen in Nasstrommelmühlen und ihrc Anwendung in der Erzaufbereitung. (Fundamental Knowledge and Recent Developments in the Fine Wet Grinding of Minerals in Ball Mills and Its Use in Ore Dressing.) Gotthold Quittkat. *Zeitschrift fur Erzbergbau und Metallhuttenwesen,* v. 2, Jan. 1949, p. 6-14.

Theory of fine grinding and optimum conditions, such as size and hardness of the "milling balls" and rate of revolution of the mill. Different types of ball mills are described and illustrated.

1A-19. Bestämning av specifika ytan pa kross—och malgods enligt gaspermeabilitetsmetoden. (Determination of the Specific Surface of Finely Divided Materials by the Gas-Permeability Method.) Jonas Svensson. *Jernkontorets Annaler,* v. 133, no. 2, 1949, p. 33-86.

Theoretical basis of the method. Two different experimental arrangements were used, an apparatus of fairly conventional type and a completely closed apparatus in which permeability was determined with air as well as with nitrogen gas at pressures between 1 and 76 cm. Hg. Nineteen tests were made on finely divided quartz and a large number on sized material, ground products, and mixtures of ground products. 48 ref.

1A-20. Investigation of Muir Inlet or Nunatak Molybdenum Deposits, Glacier Bay, Southeastern Alaska. R. S. Sanford, G. A. Apell, and F. A. Rutledge. *U. S. Bureau of Mines,* Report of Investigations 4421, Mar. 1949, 6 pages. (TN21 Un3r).

Review of beneficiation tests.

1A-21. Investigation of Sweetsprings Manganese Deposits, Monroe County, W. Va., and Craig County, Va. Harold B. Ewoldt and Robert S. Sanford. *U. S. Bureau of Mines,* Report of Investigations 4433, Mar. 1949, 16 pages.

Beneficiation tests indicated that approximately 80% of material in crude ore could be discarded by log washing; that 55% of the total Mn was recoverable as a gravity concentrate averaging 34.6% Mn.

1A-22. Physical Properties of Mine Rock. Part I. S. L. Windes. *U. S. Bureau of Mines,* Report of Investigations 4459, Mar. 1949, 79 pages.

Physical and petrographic properties of over 100 rock types from operating mines or mineral-investigation projects. Apparent specific gravity; apparent porosity; compressive strength; flexural strength (modulus of rupture); impact toughness; abrasive hardness; scleroscope hardness; modulus of elasticity (Young's modulus); modulus of rigidity; specific damping capacity; and longitudinal bar velocity. Source and geologic identifications for each type, and petrographic descriptions. Applicability of the data to mining, crushing, and grinding.

1A-23. A Method for Polishing Sections of Ores. Edward Sampson. *Economic Geology and the Bulletin of the Society of Economic Geologists,* v. 44, Mar.-Apr. 1949, p. 119-127.

Grinding is in two stages on iron laps designed to maintain a flat surface as the lap wears. Polishing is done on a lead lap. Construction and operation of the machines and grades of abrasives and special mixtures of oils. A supplementary device holding a mounted specimen mechanically permits high pressure for polishing and greatly reduces polishing time for hard materials.

1A-24. Concentrating Minerals in Cast-Iron Spirals. Walter P. Gillingham. *Compressed Air Magazine,* v. 54, Apr. 1949, p. 91-93.

Simple, ingenious apparatus which effects gravity separation of materials much like nature does it at the bends of streams. Application to a variety of minerals and to coal.

1A-25. Simple Calculations, Based on These Graphs of Screen Analyses, Make It Easier to Rate Grinding Efficiencies. A. Legsdin and Frederick L. Schenck. *Engineering and Mining Journal,* v. 150, Apr. 1949, p. 88-89.

Rapid method based on new surface area produced per unit of power input.

1A-26. (Book) Die Metallischen Rohstoffe, ihre Lagerungsverhältnisse und ihre wirtschaftliche Bedeutung. Heft 4. Kupfer. Heft 5. Mangan. Heft 6. Nickel und Kobalt. (The Metallic Raw Materials, Their Properties, Behavior, and Economic Importance. Vol. 4. Copper. Vol. 5. Manganese. Vol. 6. Nickel and Cobalt.) Georg Berg and Ferdinand Friedensburg. 195, 235, and 280 pages. 1941, 1942, and 1944. Ferdinand Enke Verlag, Stuttgart, Germany. Reproduced 1947 by J. W. Edwards, Ann Arbor, Mich. $5.25, $6.50, and $7.00.

Information is provided in two parts in each of these books. Part I contains a brief account of properties; occurrence and origin; mining and dressing; metallurgical treatment; uses; history; marketing, evaluation, and prices; strategic importance; estimated future supplies; and statistics. Part II provides a comprehensive review of the occurrences of the metal in the individual countries throughout the world, location and general nature of the principal ore-bodies. Comparative geological and mineralogical information and statistical data.

1A-27. (Book) Métallurgie: Elaboration des Métaux. (Metallurgy: Production and Fabrication of Metals.) C. Chaussin and G. Hilly. 193 pages. 1949. Dunod, 92 rue Bonaparte, Paris 6, France.

Various processes for obtaining pure or commercial ferrous and nonferrous metals—including ore treatments, smelting and refining in all their manifold variations. Furnace and other equipment.

1A-28. (Book) Vorraete und Verteilung der mineralischen Rohstoff, Ein Buch zur Unterrichtung fuer jedermann. (Resources and Distribution of Mineral Raw Materials, A Book for General Information.) F. Machatschki. 191 pages. 1948. Springer-Verlag, Vienna, Austria.

Heavy metals, light metals, precious metals, semi-metals, selenium and tellurium, rare earths, sulfur, arsenic, carbon, phosphorus, salts, and a short section on precious stones.

1A-29. (Book) The Earth and Its Resources. Ed. 2. Vernor C. Finch, Glenn T. Trewartha, and M. H. Shearer 584 pages. 1948. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.

This textbook is for courses in physical geography and earth science. The atmosphere — weather and climate; landforms—plains, plateaus, hill country, and mountains; oceans and their shores; and earth resources—waters, vegetation, soils, and minerals.

1B—Ferrous

1B-21. Anreicherung von Minette. (Concentration of Minette Ore.) Walter Luyken. *Stahl und Eisen,* v. 68, Jan. 29, 1948, p. 35-38.

Earlier methods and results. A process in which iron ore containing about 25% Fe is subjected to a magnetizing roasting process, followed by magnetic precipitation. Micrographs show the mineral constitution of the samples.

1B-22. Investigation of Cheever Limonite Deposit, Berkshire County, Mass. R. J. Burgess and Robert S. Sanford. *U. S. Bureau of Mines,* Report of Investigations 4423, Mar. 1949, 13 pages.

Beneficiation tests conducted on three samples of churn-drill sludge

that contained 31.2, 28.1, and 22.2% iron, respectively. Sink-and-float separation and flotation recoveries were not encouraging. Best results were obtained after roasting followed by attrition grinding and wet magnetic separation.

1B-23. Charleson Lean-Ore Plant to Treat Old Stockpile. R. W. Keehn. *Engineering and Mining Journal,* v. 150, Apr. 1949, p. 80-81.

Flowsheet of new jig plant of Charleson Mining Co. for beneficiating iron ore in the Missabe Mountain-Minnewas lean-ore stockpile on the Mesabi Range.

1B-24. Canada's Future Brightens as Producer of Iron Ore. John B. DeMille. *Engineering and Mining Journal,* v. 150, Apr. 1949, p. 90-91.

Known and possible future reserves in various Canadian locations.

1B-25. Fused Ore for the Openhearth. E. S. Kopecki. *Iron Age,* v. 163, Apr. 7, 1949, p. 82-86.

Continuous-fusion operation, using iron-bearing materials of any degree of fineness as raw material, for production of charge and feed ore of sizes and densities best suited for the openhearth process. Pilot-plant experiments conducted successfully on more than 1000 tons of various grades of iron-bearing materials indicate efficiency of the process, at conversion costs approximating downdraft sintering processes.

1C—Nonferrous

1C-26. Investigation of Big Ben Molybdenum Deposit, Neihart District, Cascade County, Mont. J. A. Herdlick. *U. S. Bureau of Mines,* Report of Investigations No. 4406, Feb. 1949, 22 pages.

History, location, description of deposit, sampling, and analyses. Results of routine metallurgical testing. Approximately 88.9% molybdenite was obtained with 77% recovery.

1C-27. The Occurrence of Chromium in Ilmenite From Nories Head, N.S.W., and Stradbroke Island, Queensland. *Joint Investigations of the Council for Scientific and Industrial Research and the University of Melbourne,* Investigation No. 337, May 25, 1948, 6 pages.

Results of mineralogical examination and magnetic separation of above two samples. Results are believed promising.

1C-28. Treatment of Ore From Black Jack Gold Mining Co., N. L., Near Charters Towers, Queensland. *Joint Investigations of the Council for Scientific and Industrial Research and the University of Melbourne,* Investigation No. 334, June 9, 1948, 4 pages.

Results of tabling and cyanidation tests; recommendations.

1C-29. Concentration of Lead-Zinc Silver Ore From Isobella Mine, Herberton, Q'Ld. *Joint Investigations of the Council for Scientific and Industrial Research and the University of Melbourne,* Investigation No. 333, July 7, 1948, 10 pages.

Results of sampling and beneficiation tests. Mineralogical examination, jigging, table concentration, flotation, and comparison of alternative treatment schemes. Only the zinc is believed capable of economic recovery.

1C-30. Concentration of Lead Ore From Leadville, N.S.W. *Joint Investigations of the Council for Scientific and Industrial Research and the University of Melbourne,* Investigation No. 341, July 16, 1948, 6 pages.

Results of table-concentration and flotation tests on oxidized lead ore. Effects of different crushing methods were determined.

1C-31. Gegenwärtiger Stand der Gewinnung von Indium aus Rammelsberger Erz. (Present Status of the Extraction of Indium From Rammelsberger Ore.) Reinhard Kleinert. *Zeitschrift fur Erzbergbau und Metallhuttenwesen,* v. 2, Jan. 1949, p. 14-18.

A brief historical review and the steps of enriching the In-bearing ore and of extracting and refining this metal.

1C-32. Minerals for Chemical and Allied Industries; A Review of Sources, Uses and Specifications. Part XXX. Sydney J. Johnstone. *Industrial Chemist and Chemical Manufacturer,* v. 25, Mar. 1949, p. 187-195.

Deals with zinc and zinc compounds. Ore deposits, beneficiation, smelting and refining, specifications, alloys, and uses; as well as pigments, paints, and Zn salts. Production statistics. (To be continued.)

1D—Light Metals

1D-3. Distribution of Impurities in Crystallization of Ammonium and Potassium Alums. David Schlain, John D. Prater, and S. F. Ravitz. *Industrial and Engineering Chemistry,* v. 41, Apr. 1949, p. 834-841.

Study was made because the crystallization of ammonium or potassium alum is an important step in several processes proposed for recovery of alumina from clays and alunite. 20 ref.

1D-4. Investigation of Certain High-Alumina Clays of Central Pennsylvania. Robert S. Sanford. *U. S. Bureau of Mines,* Report of Investigations 4427, Mar. 1949, 12 pages.

The method studied for extracting and recovering high-grade alumina comprised sintering pulverized ore with limestone and soda ash to convert alumina to a water-soluble form and silica to compounds virtually insoluble in water or dilute alkalies. Beneficiation tests.

For additional annotations indexed in other sections, see:

2B-117; 2B-125

2

SMELTING, REDUCTION and REFINING

2B—Ferrous

2B-107. Effect of Final Deoxidation on Low-Temperature Impact Strength of Cast Steels. B. A. Lawson. *Foundry,* v. 77, Apr. 1949, p. 74-77, 179-180.

Procedure used to develop deoxidation practices which would produce steel castings possessing both good ductility and low-temperature impact strength in both 0.40-0.50% and 0.20-0.30% C steel. Data on Ti, Al, and Ca-Ti deoxidation.

2B-108. Present Methods of Open-Hearth Furnace Charging. E. L. Diamond and A. M. Frankau. *Journal of the Iron and Steel Institute,* v. 161, Mar. 1949, p. 191-211.

Discusses the various methods and equipment on the basis of extensive time study. Recommendations for improvement.

2B-109. The Influence of Heat Transfer on Open-Hearth Furnace Charging Rate. M. W. Thring. *Journal of the Iron and Steel Institute,* v. 161, Mar. 1949, p. 212-221.

Model experiments and calculations were used to decide whether increase in the rate of charging reduces total melting time. The model consisted of paraffin wax melted by constant radiation from above. Theoretical analysis indicates that it is not advantageous to charge faster than the heat-transfer rate will permit. The ideal charging process is uniform insertion at a rate such that the roof is kept just below the maximum safe value while the fuel is being burned at the maximum rate.

2B-110. Jet Casting for Tapping Blast and Open Hearth Furnaces. Bruce S. Old and A. R. Almeida. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 315-316, 334. A condensation.

See abstract from *Iron Age,* item 2B-28, 1949.

2B-111. Melting of Quality Basic Electric Steel. Part II. (Concluded.) T. V. Simpkinson. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 335-337. A condensation.

Adjustment of analysis and final deoxidation; time under the reducing slag; effects of hydrogen; behavior of hydrogen during steel solidification; and effect of nitrogen.

2B-112. Oxygen: A Review of Its Applications in the Iron and Steel Industry. W. C. Newell. *Iron and Steel,* v. 22, Mar. 1949, p. 77-80.

103 references.

2B-113. Erzeugung von Ferromangan aus minderwertigen Erzen. (Production of Ferromanganese From Low-Grade Ores.) Hans Reinfeld. *Stahl und Eisen,* v. 68, Jan. 29, 1948, p. 39-43.

New reduction method makes it possible to obtain, in one operation, maximum Mn concentration from a minimum Mn charge—with very small loss of Mn and low fuel consumption. This method can be used for the production of specular iron with similar good results.

2B-114. Die Anwendung von Sauerstoff im basischen Siemens-Martin-Ofen. (The Use of Oxygen in the Basic Openhearth Furnace.) Kurt Guthmann and Arno Ristow. *Stahl und Eisen,* v. 68, Jan. 29, 1948, p. 50-52.

Results of various investigations in Germany and abroad.

2B-115. Untersuchungen zur aluminothermischen Gewinnung von Ferrotitan. (Research on the Aluminothermic Extraction of Ferrotitanium.) Kirt Giesen and Wilhelm Dautzenberg. *Stahl und Eisen,* v. 68, Apr. 22, 1948, p. 159-162.

Results of laboratory and large-scale experiments on different factors affecting the aluminothermal reduction to ferrotitanium of crude ilmenite containing 44% TiO_2.

2B-116. Untersuchungen uber Konverterformen und Blasbedingungen zur Erzeugung stickstoffarmen Stahles. (Research on Converter Design and Blast Conditions for the Production of Low-Nitrogen Steel.) Theo. Kootz and Gerhard Gille. *Stahl und Eisen,* v. 68, Aug. 12, 1948, p. 287-294.

Scientific principles of nitrogen pickup in the converter. Experiments with different converters revealed that the "double-bellied" converter produces steel with the lowest nitrogen content. Model tests were made with ammonia to deter-

mine conditions of nitrogen pickup and it was found that oscillation of the bath had no effect. 49 ref.

2B-117. Hochofenbetrieb mit erhohtem Gasdruck an der Gicht in Verbindung mit Sauerstoffanwendung und Erzvorbereitung. (Blast Furnace Operation With Increased Gas Pressure at the Throat Combined With the Use of Oxygen and Special Ore Dressing.) Heinz Schumacher. *Stahl und Eisen,* v. 68, Sept. 9, 1948, p. 353-357.

Correlates and summarizes recent American, German, and Russian literature.

2B-118. Production of Rimmed Steel in the Basic Electric Furnace. *Industrial Heating,* v. 16, Mar. 1949, p. 454. Based on article by A. K. Moore.

Practice at Steel Co. of Canada plant.

2B-119. Casting of Slender Ingots. *Industrial Heating,* v. 16, Mar. 1949, p. 456. Based on article by B. C. Blake.

Method of casting billet-type ingots for manufacture of light-gage final products in one conversion.

2B-120. Quality Control in the Open Hearth. Part III. Desulfurization of Pig Iron. Frank G. Norris. *Industrial Heating,* v. 16, Mar. 1949, p. 460, 462.

The desulfurization of pig iron before use in the bessemer process; the amounts and materials used; the time cycle; slag removal; best operating temperature; and the amount of desulfurization.

2B-121. Essais exécutés a l'aciérie Martin de Pompey sur l'enrichissement en oxygène de l'air de combustion. (Experiments on Use of Oxygen-Enriched Air for Combustion in the Pompey Steel Plant.) *L'Institut de Recherches de la Sidérurgie* (Saint-Germain-en-Laye, France), ser. A, No. 2, July 1948, 17 pages and 14 folded charts.

Tests performed on a 47-ton open-hearth furnace converted in 1945 for use of crude oil as fuel. Specifications of the furnace.

2B-122. La désoxydation intégrale de l'acier par l'aluminium. (Integral Deoxidation of Steel by Use of Aluminum.) J. G. Platon. *Revue de Métallurgie,* v. 45, Dec. 1948, p. 512-514.

Various methods for deoxidation of steel, citing advantages of use of Al rather than Si or Mg. Mechanism of Al deoxidation and modern large-scale methods.

2B-123. Beiträge zur Metallurgie des Hochofens. (The Metallurgy of the Blast Furnace.) Willy Oelsen and Helmut Maetz. *Stahl und Eisen,* v. 69, Mar. 3, 1949, p. 147-153.

Results of experimental work on the desulfurization of pig iron and other reactions occurring in the blast furnace. It was found that at temperatures up to 1550° C., reactions between pig iron and slag progress less far than similar reactions of a powdered mixture at temperatures so low that the mixture is still in a solid or semi-solid state. The melt is reduced rapidly above 1600° C. Expected correlations between the various reduction processes were experimentally established.

2B-124. Sulphur Equilibria Between Iron Blast Furnace Slags and Metal. Gerald G. Hatch and John Chipman. *Journal of Metals,* v. 1, sec. 3, Apr. 1949, p. 274-284.

Results of what is believed to be the first equilibrium study of the distribution of S between liquid pig iron and a wide range of blast-furnace-slag compositions. Experimental apparatus and procedure. 23 ref.

2B-125. An Approach to Taconite Utilization. John J. Howard. *Iron Age,* v. 163, Apr. 14, 1949, p. 70-71.

Technical and economic problems involved. Proposed method which reduces iron oxide to metal directly from the taconite. The taconite is ground to minus 40-60 mesh, mixed with coal or coke for reduction, briquetted, and heated to 2500° F. The reduced iron collects in globules and readily separates from the silica, which does not melt below 2900° F.

2B-126. (Book) **The Manufacture of Iron & Steel. Vol. 1.** G. R. Bashforth. 228 pages. Chapman & Hall, Ltd., 37 Essex St., London, W. C. 2, England. 21s.

Textbook intended for technical school students. Blast furnace burden, preparation of iron ores, blast furnace fuel, reactions, slags, design, plant and equipment, refractories, operation and calculations.

2B-127. (Book) **Metallurgie du Fer.** (Metallurgy of Iron.) L. Colombier. 326 pages. 1948. Dunod, 92 Rue Bonaparte, Paris 6, France.

A text for advanced study of the subject. Part I reviews theoretical principles, including thermodynamics and phase transformations. Part II is devoted to large-volume processes for production of iron and steel. Part III describes methods and equipment for producing special steels—mainly electric-furnace processes.

2C—Nonferrous

2C-18. Electrolytic Refining of Antimony Bullion. David Schlain, John D. Prater, and S. F. Ravitz. *Journal of the Electrochemical Society,* v. 95, Mar. 1949, p. 145-160.

Antimony bullion of several compositions was electrolytically refined in an electrolyte composed of antimony trifluoride and H_2SO_4. Effects of electrolyte circulation and of variation in antimony content were studied.

2C-19. Roasting Arsenical Gold Ores and Concentrates. F. R. Archibald. *Canadian Mining and Metallurgical Bulletin,* v. 42 *(Transactions of the Canadian Institute of Mining and Metallurgy,* v. 52), Mar. 1949, p. 129-139.

Roasting as preparation of refractory gold ores and concentrates for cyanidation, with particular reference to operations at the mill of Beattie Gold Mines, Quebec. 23 ref.

2C-20. Effects of Melting Atmosphere, Time at Temperature and Degasification on Properties of Valve Bronze. W. H. Baer and B. M. Loring. *American Foundrymen's Society,* Preprint No. 49, 1949, 5 pages.

100-lb melts made in air, under dry charcoal, and under damp charcoal were studied. First type of atmosphere produced most favorable mechanical properties.

2C-21. Electrolytic Preparation of Zinc Dust. *Canadian Chemistry and Process Industries,* v. 33, Mar. 1949, p. 216-217.

German method of production of zinc dust from sodium zincate solution, which results in a much purer material than that from the zinc retorts.

2C-22. Concentration of the SO_2 Content of Dwight-Lloyd Sintering Machine Gas by Recirculation. W. S. Reid. *Journal of Metals,* v. 1, sec. 3, Apr. 1949, p. 261-266.

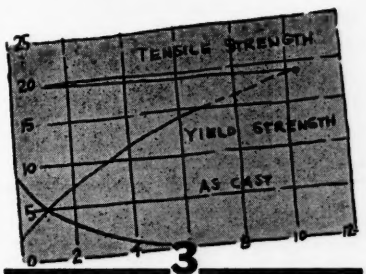
Development of process for recovery of a commercial grade of SO_2 from the gases from above machines operating on a lead charge.

2D—Light Metals

2D-13. Grain Refining of Aluminum Alloys and Its Effect on Physical Properties. Walter Bonsack and O. Tichy. *American Foundrymen's Society,* Preprint No. 35, 1949, 12 pages.

Methods for grain refining by increasing rate of solidification and by employing grain refiners. Four types of Al alloys were studied, with Ti used as a refining addition.

For additional annotations indexed in other sections, see:
1A-27; 4D-24; 15-23-24



3 PROPERTIES

3A—General

3A-72. The Friction of Dry and Lubricated Surfaces as Determined by the Stick-Slip Method. F. Morgan, M. Muskat, and D. W. Reed. *Lubrication Engineering,* v. 5, Apr. 1949, p. 75-82, 103.

Results of a friction survey of various metal combinations made with an apparatus similar to that of Bowden and Leben. Apparatus and technique. Method for calculation of friction coefficients and statistical analysis of the data. 12 ref.

3A-73. Complementary Minimum Principles for an Elastic-Plastic Material. H. J. Greenberg. *Quarterly of Applied Mathematics,* v. 7, Apr. 1949, p. 85-95.

The mechanical behavior of bodies consisting of an isotropic elastic-plastic material which obeys the stress-strain law of Prandtl and Reuss. Such material has a sharply defined yield point and does not exhibit work hardening. Assumed to be incompressible in the elastic as well as the plastic range. 14 ref.

3A-74. Recent Developments in the Mathematical Theory of Plasticity. William Prager. *Journal of Applied Physics,* v. 20, Mar. 1949, p. 235-241.

The general technique used in the discussion of stress-strain laws for inviscid elastic-plastic materials with work hardening. The case in which mechanical state is determined by the components of stress and permanent strain is investigated. Various problems of plastic equilibrium. 30 ref.

3A-75. A Cloud-Chamber Study of Meson Absorption by Thin Pb, Fe, and Al Foils. W. Y. Chang. *Reviews of Modern Physics,* v. 21, Jan. 1949, p. 166-180.

Review of literature; experimental arrangement; results. 30 ref.

3A-76. Fundamentals of Creep. Howard Scott. *Metal Progress,* v. 55, Mar. 1949, p. 343-344.

Takes issue with conclusion in Feb. 1948 issue that there is no correlation between creep and tensile strength. Defends use of complex "practical" alloys, which, although containing at least eight or nine metallic components, behave in a regular and predictable manner.

3A-77. Deltamax—A New Magnetic Core Material. W. S. Spring. *Iron Age,* v. 163, Mar. 31, 1949, p. 70-73.

Techniques for economically producing a 50% Ni-Fe alloy having, in addition to a rectangular hysteresis loop, sharply defined knees,

low coercive force, and a useful range of induction in excess of 26 kilogausses. Predicted that this material, which will soon be economically available as toroidally-wound cores, will find wide application in the electronics field.

3A-78. Magnetic Intensity of Certain Iron-Nickel Alloys and Lag of Change of Magnetization. (In Russian.) R. V. Telesnin. *Zhurnal Eksperimental 'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 18, Nov. 1948, p. 970-975.

The magnetic intensity of binary alloys containing 43-78.5% Ni was investigated. Strong dependence of magnetic intensity on elongation of the test specimen; a new phenomenon of lag in change of magnetization consisting of reversal of the magnetization vector. Method of investigation. 13 ref.

3A-79. Study of the Plasticity of Sheet Material. (In Russian.) Ya. B. Fridman and A. A. Bat. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1462-1469.

Investigated for a series of different materials, including steels with high mechanical properties, under tensile stress on plain and notched test specimens. Theoretical conclusions and experimental data.

3A-80. The Role of "Dislocation" in the Process of Creep. (In Russian.) I. A. Oding. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Dec. 1948, p. 1795-1802.

Analyzes all possible mechanisms for strengthening and weakening of metals during creep on the basis of the theory of dislocation. Application of this theory is said to resolve certain controversies concerning the mechanism of the creep process. Describes an additional mechanism of weakening caused by "dislocation" of the strength of metals.

3A-81. Sur la déformation plastique et la rupture des métaux. (Plastic Deformation and Fracture of Metals.) Pierre Laurent and Raymonde Laurent-Lamothe. *Revue de Métallurgie,* v. 45, Dec. 1948, p. 515-520.

The plastic deformation of monocrystals, twinned crystals, and polycrystals. Factors involved in fracture after plastic deformation are analyzed for mono and polycrystals. The role of plastic phenomena, particularly in fatigue and stress corrosion.

3A-82. Dynamic Torsion of Metals and Alloys Used in Aircraft Construction. Their Elastic Limit and Micro-Plastic Deformation Under Reversed Torsional Energy Loads. Parts I and II. Georges Welter. *Metallurgia,* v. 39, Feb. 1949, p. 188-190; Mar. 1949, p. 253-256.

Results of investigation on maximum possible impact loads with no permanent micro-deformation under torsion loads. Static properties, dynamic loads necessary to attain first permanent deformations, as well as those up to the yield point of the material. Specially devised torsional-testing impact machine used for applying repeated and increasing dynamic loads. Part II gives data on Duralumin 24 ST, Mg alloy 57S, mild steel and Ni-Cr steel. (To be continued.)

3A-83. The Cause of Anisotropy in Permanent Magnet Alloys. K. Hoselitz and M. McCaig. *Proceedings of the Physical Society,* v. 62, sec. B, Mar. 1, 1949, p. 163-170.

Measurements of magnetostriction. It is concluded that the domain magnetization is, in the absence of a field, along the crystallographic direction which makes the smallest angle with the axis of anisotropy. Effects of tempering.

3A-84. On the Surface Free Energy of Certain Metals. K. Huang and G. Wyllie. *Proceedings of the Physical Society,* sec. A, v. 62, Mar. 1, 1949, p. 180-191.

Model for calculating surface energy and surface double layer for a number of monovalent metals. Valence electrons are treated according to a Sommerfeld model, and positive charge is distributed uniformly through the metal. Peculiarly low values of surface tension in monovalent metals result directly from properties of free electron gas. 15 ref.

3A-85. Metals in Instruments; A Metallurgical Survey of the Materials Used. E. H. Bucknall. *Metal Industry,* v. 74, Mar. 4, 1949, p. 163-165, 173; Mar. 11, 1949, p. 183-185; Mar. 18, 1949, p. 209-210.

Applications which are dependent upon possession of physical properties at a specially low, high, or constant level, in combination with satisfactory engineering properties. Special attention is given to thermal expansion, elastic modulus, and magnetic properties. Part 2 deals with use in length standards, with thermostatic bimetals, and with glass-to-metal seals. Part 3 deals with ferromagnetism and temperature control applications. 39 ref.

3A-86. The Physics of Sheet Steel. 25. The Problem of Cyclic Magnetisation. (Continued.) G. C. Richer. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 525-526, 528; Apr. 1949, p. 742-746, 750.

A working generalization of the B-H relationships in the Rayleigh region of the cyclic induction curve. Extent of agreement between experiment and theory for "single-phase" conditions. April installment describes hypothetical generation of families of hysteresis loops and the Steinmetz law of variation of cyclic hysteresis loss with maximum cyclic induction.

3A-87. Theories of the Mechanical Properties of Metals. N. F. Mott. *Research,* v. 2, Apr. 1949, p. 162-169.

Critically reviews existing theories, showing need for a broad program of experimental research to reduce the subject to quantitative terms. 28 ref.

3A-88. The Fatigue Problem in Metals With Special Reference to Wire Materials. John N. Kenyon. *Wire and Wire Products,* v. 24, Apr. 1949, p.317-319.

First of a series reviews briefly the historical development.

3A-89. (Book) **Zharouporny Splav.** (Heat Resisting Alloys.) Vol. 3. I. I. Kornilov. 120 pages. 1947. Academy of Sciences of the USSR, Moscow, U.S.S.R.

Results of theoretical and experimental investigation of the most important factors in developing heat-resisting alloys. Solid solutions of iron with a series of alloying elements were studied thoroughly, particularly regions of the constitution diagram which include heat resistant materials. It is shown that the ternary system Fe-Cr-Al represents the most important combination of elements for use between 800 and 1500° C. Two alloys have been developed and introduced industrially in the USSR, replacing the Ni-Cr alloys and platinum. 48 ref.

3B—Ferrous

3B-57. Structural High-Tensile (Low Alloy) Steel. O. A. Kerensky. *Engineer,* v. 187, Mar. 4, 1949, p. 238-241. A condensation.

Types of the above; methods of manufacture (cold working, heat treating, and alloy additions); welding; corrosion; allowable stresses; effect of fatigue; and economics of use. Weight savings make wider use of such steels in structures highly desirable. 32 ref.

3B-58. Meeting High Performance Demands in Engineering Construction With Meehanite Metal. A. Campion. *Engineer,* v. 187, Mar. 4, 1949, p. 243-245. A condensation.

Mechanical properties of the five types and applications.

3B-59. Effect of Variation in Silicon Content on the Properties of Silicon-Manganese Spring Steel. W. E. Bardgett and F. Gartside. *Metallurgia,* v. 39, Feb. 1949, p. 171-177.

Effect of varying the silicon content between 0.5 and 2.64%, on susceptibility to decarburization, tempering, hardenability and mechanical properties, including fatigue. Decrease in silicon below 1.5% increases susceptibility to decarburization, while increase beyond the upper limit is liable to result in inferior notch toughness and fatigue strength.

3B-60. Study of the Causes for and Corrective Measures Necessary to Prevent Cracking of Boiler Plates Made of Various Steels. Ray McBrian, R. C. Bardwell, R. E. Coughlan, H. H. Service, Walter Hedeman, and J. D. Johnson. *Master Boiler Makers' Association, Official Proceedings,* 1948, p. 220-235; discussion, p. 235-253.

Studies of failed boiler-shell materials received from the various railroads in the U. S. and a continuing investigation into materials for construction of locomotive boilers. No satisfactory material has been developed which can be guaranteed to resist cracking in riveted construction.

3B-61. Wirkung des Kaltreckens und der nachfolgenden kunstlichen Alterung auf die Festigkeitseigenschaften von Stahl besonders bei mehrachsiger Verformung. (Effect of Multiaxial Cold-Working Followed by Artificial Aging on the Strength Properties of Steel.) Alfred Krisch. *Stahl und Eisen,* v. 68, Apr. 22, 1948, p. 165.

The "Bauschinger effects" of stress in two or three main directions. Results of Krisch and Straeter's experiments with thick-walled tubes of alloyed and unalloyed steels.

3B-62. Possible Embrittlement of Cold Worked 18-8 at Moderate Temperatures. M. A. Scheil. *Metal Progress,* v. 55, Mar. 1949, p. 342-343.

Test results which show loss of ductility and considerable elongation on tensile testing of common grades of 18-8 at temperatures in the neighborhood of 350° F. Tensile strength of Type 304 was reduced from about 150,000 psi. at 70° F. to about 135,000 psi. at 350° F. Further information is solicited on this unexplained phenomenon.

3B-63. Small-Angle Scattering of Neutrons in Iron. D. J. Hughes, M. T. Burgy, R. B. Heller, and J. W. Wallace. *U. S. Atomic Energy Commission,* AECD-2363, Aug. 1948, 7 pages.

New effect which takes place in unmagnetized iron, but not in magnetized. Results of measurements and theory involved.

3B-64. Influence of Stress on the Hall Effect in Iron-Nickel Alloys Under Positive Striction. (In Russian.) G. P. Priporova. *Zhurnal Eksperimental 'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 18, Nov. 1948, p. 1041-1044.

The influence of plastic and elastic deformations on the Hall emf.

in an Fe-Ni alloy under positive stress. Elastic deformation does not influence the value of the Hall coefficient; on the contrary, in the case of plastic tensile stresses, the Hall coefficient decreases with deformation.

3B-65. Influence of Alloying Elements on the Thermal Stability of Chromium-Nickel Austenite. (In Russian.) A. M. Borzdika. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Nov. 21, 1948, p. 265-267.

The influences of W, Mo, Ti, and Cb on the heat resistance of Cr-Ni steels. The marked difference in atomic diameters of the above elements and of Fe, Cr, and Ni is the main cause of the increase in creep strength of the alloy and, hence, its higher heat resistance.

3B-66. Evaluation of Cold Brittleness of Steel. (In Russian.) D. M. Zagorodskikh. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1499-1501.

The influence of phosphorus. Recommends that steels be tested for impact strength, not at room temperature, but at the critical temperature of brittleness.

3B-67. Effect of Boron on Structure and Some Physical Properties of Plain Cast Irons. A. I. Krynitsky and Harry Stern. *American Foundrymen's Society,* Preprint No. 47, 1949, 13 pages.

Additions, ranging from 0.001-0.48% B were determined by casting chill plates, wedge castings, and arbitration bars. 29 ref.

3B-68. Stals Aldring. (Aging of Steel.) B. D. Enlund. *Jernkontorets Annaler,* v. 133, no. 1, 1949, p. 1-28.

Low-carbon steels often show considerable embrittlement on aging at room temperature or at different elevated temperatures if they are previously cold worked. If the steel is transformed into a sufficiently fine-grained condition no embrittlement will occur. Grain refinement may be by Al addition and normalizing or by quenching and tempering. The increase in hardness on aging after coldworking was found to be definitely related to grain size.

3B-69. Développement, effets et meseurs des précontraintes superficielles des pieces de machine. (Development, Effect and Methods of Induction of Surface Stresses in Machine Parts.) Jacques Pomey, Louis Abel, and Francois Goutel. *Comptes Rendus,* v. 228, Jan. 17, 1949, p. 223-224.

Experimental results indicate that the development of triaxial stresscs close to the surface improves elastic and fatigue properties of steel machine parts. Mechanism of this phenomenon. Method of production of such stresses.

3B-70. Meeting High Performance Demands in Engineering Construction With Meehanite Metal. A. Campion. *Metallurgia,* v. 39, Mar. 1949, p. 272-276.

Properties and applications.

3B-71. Selecting Steels With High Creep Strength. *Steel Processing,* v. 35, Mar. 1949, p. 143-144. Reprinted from *Mechanical World* (London).

A general discussion.

3B-72. Low Temperature Properties of the Austenitic Stainless Steels. R. H. Henke. *Product Engineering,* v. 20, Apr. 1949, p. 104-107.

How temperatures of −320° F. change impact strength, tensile strength, ductility, and endurance limit of annealed, cold drawn, and welded Cr-Ni stainless steels. Comparisons with straight Cr stainless steels.

3B-73. Gray Iron Castings. T. C. Du Mond. *Materials & Methods,* v. 29, Apr. 1949, p. 71-78.

Properties and how to process such castings. Alloy and controlled irons. Finishing, machining, heat treating, and welding are dealt with.

3B-74 Gray Iron as a Die Material. C. O. Burgess. *Tool Engineer,* v. 22, Apr. 1949, p. 26-28.

Properties of gray irons of controlled analysis which make them useful for dies. Design principles.

3C—Nonferrous

3C-45. Thermal Conductivity of Superconductors. J. K. Hulm. *Nature,* v. 163, Mar. 5, 1949, p. 368-369.

Results of measurements of the specific thermal conductivity at liquid helium temperatures of a series of tin specimens, ranging from spectroscopically pure tin to alloys containing up to 4% Hg. A tantalum specimen was also measured.

3C-46. Deformation of Single Crystals of Tin in Solutions of Oleic Acid. D. S. Kemsley. *Nature,* v. 163, Mar. 12, 1949, p. 404.

Experiments of Rehbinder and coworkers were repeated as a prelude to further work on the effect of surface-active substances on metallic friction. Results show no such effect.

3C-47. Ferromagnetic Alloys in the System Copper-Manganese-Indium. Robert R. Grinstead and Don M. Yost. *Physical Review,* ser. 2, v. 75, Mar. 15, 1949, p. 984-985.

Results of thermal analyses.

3C-48. The Elastic Properties of Metallic Alloys. R. Cabarat, L. Guillet, and R. Le Roux. *Journal of the Institute of Metals,* v. 75, Feb. 1949, p. 391-402. Translated from the French.

Effect of constitution on elastic modulus and logarithmic decrement in Cu-Sn and Cu-Zn alloys. Method consisted of causing longitudinal vibrations in the specimens by electrostatic means thereby creating very small strains at a high frequency. 23 ref.

3C-49. Fundamental Considerations Concerning the Behavior of Bearings. R. W. Dayton. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 4-22; discussion, p. 55-56; 137-139; 146-147.

Hydrodynamic lubrication and the failure of present theory; frictional and other properties of bearing materials in general; properties of specific conventional bearing materials, showing in what respects they meet or fail to meet ideal requirements. 14 ref.

3C-50. Some General Comments on Bearings. Carl E. Swartz. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 23-34; discussion, p. 55-56.

The important properties of an ideal bearing: low modulus of elasticity; high fatigue resistance; high corrosion resistance; medium melting point; and excellent wettability by lubricant. Examples of fatigue cracks and corrosion.

3C-51. Discussion of Satco Metal. R. J. Shoemaker. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 137-139.

Properties of above which is a Pb-base alloy containing 95-98% Pb with balance Ca, Sn, and other hardeners. Advantageous properties and applications.

3C-52. Bronze-Backed Bearings. B. J. Esarey. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 174-188; discussion, p. 205-207.

Compositions and properties of the various bronze and babbitt bearing alloys. Types of bearing, with respect to design and method of fabrication.

3C-53. The Selection of Bearing Materials. Arthur F. Underwood. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 210-222; discussion, p. 146-147.

Properties to be considered. Fatigue resistance, deformability, scoring resistance, and corrosion resistance are considered most important. Graph shows approximate importance of each factor for six major types of bearing materials.

3C-54. Messung der Absorptionskonstante von Gold im Ultraviolett und Sichtbaren. (Measuring the Absorption Constants of Gold in Ultraviolet and Visible Light Rays.) Wilhelm Elfers. *Zeitschrift fur Physik,* v. 125, Dec. 10, 1948, p. 276-277.

Determines the above by measuring the gradient of light rays passing through layers of electrolytically deposited and vapor-deposited gold. Results are considerably higher and more accurate than those obtained by the polarization method.

3C-55. Composition, Structure & Properties of Iodide Titanium. Felix B. Litton and Bruce W. Gonser. *Metal Progress,* v. 55, Mar. 1949, p. 346-347.

3C-56. Properties of Wrought Commercially Pure Titanium Prepared by Arc Melting & Casting. C. I. Bradford, J. P. Catlin, and E. L. Wemple. *Metal Progress,* v. 55, Mar. 1949, p. 348-350.

Physical, mechanical, and miscellaneous fabricating properties. Possible applications.

3C-57. Fatigue & Corrosion of Sintered & Rolled Titanium. W. Lee Williams and William C. Stewart. *Metal Progress,* v. 55, Mar. 1949, p. 351-353.

Data obtained on titanium made by the Bureau of Mines in the following forms; sheet 0.0625 in. thick and 6 1/16 in. wide, bar ⅞-in. diam., and wire 0.1265-in. diam. Possible applications.

3C-58. Engineering Properties of Sintered & Rolled Titanium. N. E. Promisel. *Metal Progress,* v. 55, Mar. 1949, p. 354-355.

Results of mechanical and spot-weld testing.

3C-59. Mechanical Properties of Wrought Titanium Alloys Made by Arc Melting or by Sintering. Howard C. Cross. *Metal Progress,* v. 55, Mar. 1949, p. 356-358.

Data confirm beneficial effects of C, O_2, N_2, Mo, W, and Cr. Additional work on effects of Cr, Mo, Ni, Cu, Pb, Mg, Si, Mn, V, Fe, and Co is under way. Changes in tensile properties of pure Ti and four of its alloys on cold rolling to 50% reduction.

3C-60. Properties of Binary Sintered & Rolled Titanium Alloys. E. I. Larsen, E. F. Swazy, L. S. Busch, and R. H. Freyer. *Metal Progress,* v. 55, Mar. 1949, p. 359-361.

Confined to alloys containing more than 90% Ti. Data on mechanical properties and electrical resistivity of alloys in the hot rolled, cold rolled and annealed conditions. Resistance to oxidation, formation of low-melting phases, and ease of hot and cold working. H_2, Be, B, Al, In, C, Si, Zr, N_2, V, O_2, Cr, Mo, W, Mn, Fe, Co, and Ni were investigated as additive elements.

3C-61. High-Temperature Properties of Titanium Alloy Castings. P. H. Brace and W. J. Hurford. *Metal Progress,* v. 55, Mar. 1949, p. 362-363.

Results of creep-rupture and tensile tests on alloys containing 30-50% or more of high-melting materials. Alloys comparing favorably with conventional high-temperature materials and considerably lighter

were obtained. Best yield strengths were obtained with Ti-Cr base (20-40% Cr) alloys containing Mo and W in 4-1 atomic ratio.

3C-62. Properties of Melted & Forged Titanium-Chromium Alloys. D. J. McPherson and M. G. Fontana. *Metal Progress,* v. 55, Mar. 1949, p. 366-367.

Induction-furnace-melted alloys were largely unsatisfactory; most of the work was done with arc-melted alloys prepared at Battelle Memorial Institute. Mechanical properties, acid and salt-solution corrosion; scaling characteristics; and microstructure as forged and after annealing and quenching.

3C-63. The Electrical Conductivity of Bismuth Fibers. I. Magneto Resistance and the Crystalline Structure. B. Donovan and G. K. T. Conn. *Philosophical Magazine,* ser. 7, v. 40, Mar. 1949, p. 283-296.

Experiments on the change of electrical resistance of bismuth in a magnetic field using specimens in the form of thin fibers. Variation of resistance as a function of orientation was studied in two main cases; fiber axis parallel and perpendicular to the axis of rotation. 18 ref.

3C-64. Physical Properties of Intermetallic Compounds of Constant Composition. (Mechanism of Conductivity of Mg_3Sb_2). (In Russian.) B. I. Bolmaks and V. P. Zhuze. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Dec. 1948, p. 1459-1477.

Specific electrical conductivity, Hall effect, thermal emf., and heat conductivity. Analysis of the data indicates that Mg_3Sb_2, a typical representative of the phases of constant composition, is a semiconductor, from the point of view of its electrical properties. 18 ref.

3C-65. Possible Zonal Structure of the Energy Spectrum of Mg_3Sb_2. (In Russian.) T. A. Kontorova. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Dec. 1948, p. 1478-1484.

Investigated by the method of "weakly-bound" electrons. The effect of local levels in an alloy. Theoretical bases of the problem. Apparently, the above investigated compound, at low temperatures, should be considered a metal with very low conductivity, but, at high temperatures, a semiconductor.

3C-66. Electrical Conductivity of the Zinc-Antimony System. (In Russian.) I. V. Mochan. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Dec. 1948, p. 1485-1493.

Electrical and thermal conductivities at the stoichiometric point using the method of Vekshinskii. Application of this method and apparatus used. Results indicate that the compound ZnSb is a semiconductor having bonds of nonmetallic character.

3C-67. Photoconductivity of Certain Intermetallic Compounds. (In Russian.) V. P. Zhuze, I. V. Mochan, and S. M. Ryvkin. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Dec. 1948, p. 1494-1497.

Photoconductivity in the intermetallic compounds ZnSb and Mg_3Sb_2. Spectral distribution of the photoconductivity was determined. Investigation indicates the semiconductive nature of the compounds.

3C-68 Effect of Composition on Properties and Structure of Cast Monel. J. T. Eash and T. E. Kihlgren. *American Foundrymen's Society,* Preprint No. 9, 1949, 10 pages.

Effect of changes in base composition, melting practice and certain impurities. Effect of Cu-Ni ratio, and Si, C, Mg, Pb, and Zr inclusions.

3C-69. Ferromagnetische Wechselwirkungen in Manganlegierungen. (Ferromagnetic Reciprocal Effects in Manganese Alloys.) L. Castelliz and F. Halla. *Acta Physica Austriaca,* v. 2, Feb. 1949, p. 348-355.

The magnetic susceptibilities of ternary Mn alloys, compared with the magnetic moments of atoms of Ni, Co, and Fe as measured by Sadron and Marian. The ε-phase of the Mn-Sb system was established by magnetic investigation of its structure.

3C-70. A Nickel-Aluminum-Molybdenum Creep Resistant Alloy. H. V. Kensey and M. T. Stewart. *Canadian Journal of Research.* v. 27, sec. F, Feb. 1949, p. 80-98.

Study of a series of these alloys to develop one for use under stress at 815° C. and above. Certain combinations of the three metals possess tensile strengths well over 100,000 psi. at room temperature; certain characteristic microstructures, dependent upon the Ni-Al ratio, are essential for these high strengths. Creep-rupture tests at 815° C. showed that some of these alloys are superior in many respects to existing high-temperature alloys.

3C-71. The Influence of Calcium on the Creep Characteristics of Lead. J. Neill Greenwood and J. H. Cole. *Metallurgia,* v. 39, Mar. 1949, p. 241-245.

Addition of small amounts of Ca to Pb resulted in a marked reduction in creep rate, and although there are indications that aging occurs after rolling, the alloy is still superior to pure lead and copper-lead. Technical difficulties and methods for eliminating.

3C-72. Initial Investigation of Carbide-Type Ceramal of 80-Percent Titanium Carbide Plus 20-Percent Cobalt for Use as Gas-Turbine-Blade Material. Charles A. Hoffman, G. Mervin Ault, and James J. Gangler. *National Advisory Committee for Aeronautics,* Technical Note No. 1836, Mar. 1949, 49 pages.

Performance in a quasi-service gas-turbine unit. Alloy blades were used in the same unit for comparison. Elevated-temperature, short-time tensile, and thermal-shock investigations were conducted on the ceramal material. Results were encouraging. 10 ref.

3C-73. Magnetic Behaviour of Zinc and Cadmium at Low Temperatures. L. Mackinnon. *Proceedings of the Physical Society,* v. 62, sec B Mar. 1, 1949, p. 170-180.

The de Haas-van Alphen effect in zinc was investigated at liquid helium temperatures using a torsion method. Effect takes the form of a variation of susceptibility along the hexagonal axis which is periodic in the applied magnetic field. Although of similar structure, Cd did not show the effect.

3C-74. Permanent Magnets. James R. Ireland. *Machine Design,* v. 21, Apr. 1949, p. 153-160, 224-225.

Primary factors in the design of permanent magnets used to energize or control. Curves show variations of magnetic properties with dimensional ratios and with Alnico alloy composition.

3C-75. Office of Naval Research and NACA Metallurgical Investigation of a Large Forged Disc of Inconel X Alloy. Howard C. Cross and J. W. Freeman. *National Advisory Committee for Aeeronautics,* Technical Note No. 1770, Apr. 1949, 31 pages.

Properties were studied at room temperature, 1200, 1350, and 1500° F. in the solution-treated and aged condition. Results of tensile, impact, rupture, time-deformation, creep, and structural-stability tests.

3C-76. Titanium: A New Metal. George A. W. Boehm. *Scientific American,* v. 180, Apr. 1949, p. 48-51.

Properties, recovery methods, and present and potential applications.

3C-77. Beryllium Copper as a Spring Material. John T. Richards. *Machinery,* v. 55, Apr. 1949, p. 169-174.

Properties. Design changes desirable on substitution of Be copper for other materials.

3D—Light Metals

3D-21. Tension Properties of Aluminum Alloys in the Presence of Stress-Raisers. I. Effects of Triaxial Stress States on the Fracturing Characteristics of 24S-T Aluminum Alloy. A. W. Dana, E. L. Aul, and G. Sachs. *National Advisory Committee for Aeronautics,* Technical Note No. 1830, Mar. 1949, 55 pages.

Effects of circumferential notches on tensile-test bars. Two variations in notch contour, namely, notch radius and depth, were studied; also two different surface conditions.

3D-22. Aluminum Alloy Bearings—Metallurgy, Design and Service Characteristics. H. Y. Hunsicker. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 82-118; discussion, p. 136-137.

Commercial alloys; performance characteristics; and fabrication procedures. 58 ref.

3D-23. Note on the Effect of Impurities and Cold Work on the Thermo-electric Power of Aluminium. J. K. Galt. *Philosophical Magazine,* ser. 7, v. 40, Mar. 1949, p. 309-314.

Recent observations of Crussard are discussed theoretically. Dissolved impurities produce a change in the thermo-electric power of pure Al which can be understood in terms of electronic band structure. When impure Al is cold worked, variation of thermo-electric power with time and temperature is changed. An explanation in terms of the theory of dislocations is proposed.

3D-24. Change of Electrical Resistance of Alloys During Aging. Z. Matyas. *Philosophical Magazine,* ser. 7, v. 40, Mar. 1949, p. 324-337.

Mechanism by which conduction electrons in pure Al are scattered when an external field is applied. Application of these results to dilute solid solutions of Al permits prediction of change of resistivity during aging. Two alloys are considered: duralumin and an Al-Ag alloy in two different stages of aging.

3D-25. Tension Properties of Aluminum Alloys in the Presence of Stress-Raisers. II. Comparison of Notch Strength Properties of 24S-T, 75S-T, and 24S-T86 Aluminum Alloys. E. L. Aul, A. W. Dana, and G. Sachs. *National Advisory Committee for Aeronautics,* Technical Note No. 1831, Mar. 1949, 62 pages.

142 references.

3D-26. Elevated-Temperature Compressive Stress-Strain Data for 24S-T3 Aluminum-Alloy Sheet and Comparisons With Extruded 75S-T6 Aluminum Alloy. William M. Roberts and George J. Heimerl. *National Advisory Committee for Aeronautics,* Technical Note No. 1837, Mar. 1949, 11 pages.

Results obtained at stabilized elevated temperatures up to 700° F., exposure times of ½ to 2 hr., and strain rates of 0.002-0.006 per min.

3D-27. Typical Characteristics of Magnesium Alloys. *Welding Engineer.* v. 34, Apr. 1949, p. 65.

A tabulation.

3D-28. Commercial Aluminum Casting Alloys. W. E. Sicha. *American Society for Metals,* "Physical Metallurgy of Aluminum Alloys," 1949, p. 129-166.

Properties and applications of the various alloys and the finished castings. Amenability to heat treatment and corrosion resistance. Compositions, physical and mechanical properties, and recommended heat treatments.

3D-29. Sur l'influence de la déformation plastique sur le module d'élasticité. (Influence of Plastic Deformation on Modulus of Elasticity.) Pierre Laurent and Michel Eudier. *Comptes Rendus,* v. 228, Jan. 17, 1949, p. 225-226.

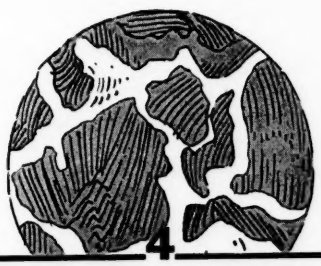
The fluctuation of modulus of elasticity during creep testing of an Al-Cu alloy containing 9.7% Cu at room temperature. It was found that the final increase of the modulus of elasticity (after 54-64 hr.) is caused by modification of the structure of the material; and that the initial decrease is caused by plastic deformation.

3D-30. Experimental Determinations of Stopping Powers Using Alpha-Particles of 15 to 37 Mev. E. L. Kelly. *Physical Review,* ser. 2, v. 75, Apr. 1, 1949, p. 1006-1007.

The integrated stopping power relative to Al was measured for Cu, Ag, Ta, Bi, and Th using alpha-particles of approximately 15-28 Mev. and 28-37 Mev. energies.

For additional annotations indexed in other sections, see:

1A-22; 2B-107; 2C-20; 6B-62; 7D-19; 8-81-90; 11-120; 14B-48; 20C-9; 23C-20; 24A-52



4 CONSTITUTION and STRUCTURE

4A—General

4A-29. Atomic Structure of Metals. H. H. Bleakney. *Canadian Metals and Metallurgical Industries,* v. 12, Mar. 1949, p. 14-17, 26, 28-29.

Elementary explanation of crystal, molecular, and atomic structure; equilibrium diagrams and transformations.

4A-30. Role of Dislocations in Crystal Growth. W. K. Burton, N. Cabrera, and F. C. Frank. *Nature,* v. 163, Mar. 12, 1949, p. 398-399.

The theory of Becker and Döring (Germany, 1935) regarding nucleation in the formation of liquid or solid phases from vapor is critically examined. It is concluded that crystals do not grow at low supersaturations unless they contain dislocations. On the other hand, an excessive density of dislocations also inhibits growth, particularly at very low supersaturations.

4A-31. A Grain Boundary Model and the Mechanism of Viscous Intercrystalline Slip. T'ing-Sui Ke. *Journal of Applied Physics,* v. 20, Mar. 1949, p. 274-280.

Study of activation energy associated with viscous intercrystalline slip shows that conventional theories are untenable. A grain-boundary model is described in which the transition region is considered to consist of numerous disordered groups of atoms or diffused holes. Intercrystalline slip occurs through atomic rearrangement by thermal agitation within each "disordered group" by a shear process involving as units of flow only a few atoms. A unified viewpoint as to the mechanism of viscous intercrystalline slip, volume diffusion in metals, and constant-rate creep of metal crystals under small stress. Experiments on the influence of previous deformation and impurities on grain-boundary viscosity. 22 ref.

4A-32. Some Crystal-Boundary Phenomena in Metals. B. Chalmers. *Proceedings of the Royal Society,* ser. A, v. 196, Feb. 22, 1949, p. 64-73.

Techniques for preparing specimens of tin and of lead consisting of two or three crystals with controlled orientations. The direction of formation of the boundary between two crystals is shown to be dependent on the relative orientations of the crystal axes, and to be the result of a variation of the solid-liquid equilibrium temperature with the crystallographic characteristics of the solid surface in contact with the liquid. A qualitative explanation is proposed in terms of a theory of melting and freezing. New observations of the "macromosaic" effect.

4A-33. Zur Theorie der Raum- und Gitterspannungen. (The Theory of Space and Lattice Stresses.) Siegfried Schwaigerer. *Stahl und Eisen,* v. 68, Dec. 2, 1948, p. 483. Based on article by H. Brandenberger, *Schweizerische Bauzeitung,* v. 65, 1947, p. 509-515, 667-670, 681-685.

A brief critical discussion of the theory by which the causes of fracture of tough substances, flow phenomena, the Bauschinger effect, etc., are explained.

4A-34. Uber die Veredlung des Silumins. (Improvement of the Properties of Silumin.) Erich Scheil and Ruth Zimmermann. *Zeitschrift fur Metallkunde,* v. 40, Jan. 1949, p. 24-29.

The effect of supercooling on eutectic crystallization and a method of calculating the degree of supercooling from the shift of the eutectic. The grain refining of silumin and of cast iron is explained as a process of supercooling of the eutectic. It is shown that the sodium in refined silumin may be in the form of two different phases. 13 ref.

4A-35. Généralités sur les textures d'orientation préférentielle. (General Discussion of Structures With Preferred Orientations.) J. Hérenguel. *Revue de Métallurgie,* v. 45, Dec. 1948, p. 505-511.

Explains "preferred orientation". Use of the microscope, after etching, is said to be particularly well suited to analysis of such structures.

4A-36. Macroscopic Description of the Phenomenon of Twinning of Crystals. (In Russian.) M. Lifshits. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 18, Dec. 1948, p. 1134-1143.

Description of the phenomenon based on a theory of the nonlinear relationship between stress deformation tensors. The consequences of requiring mechanical and thermodynamic stability. Obtained results permit satisfactory interpretation of most of the effects observed by Garber. 11 ref.

4A-37. A Dynamical Model of a Crystal Structure. II. Lawrence Bragg and W. M. Lomer. **III.** W. M. Lomer. *Proceedings of the Royal Society,* ser. A, v. 169, Mar. 22, 1949, p. 171-194.

A recent paper by Bragg and Nye described the behavior of an assemblage of bubbles on the surface of a soap solution and its relationship to the behavior of metals under stress. Part II gives results of use of the technique for study of plastic properties. The analogy with metals was best for bubbles of about 1.2 mm. diam. In Part III, maximum shear strain under which a two-dimensional close-packed lattice is stable was calculated in terms of forces between lattice components.

4A-38. Nitrogen and Hydrogen in Metals. *Journal of Metals,* v. 1, sec. 1, Apr. 1949, p. 8-12.

Solubility and effects on structure and properties, with emphasis on steel.

4A-39. The Beryllium-Iron System. R. J. Teitel and Morris Cohen. *Journal of Metals,* v. 1, sec. 3, Apr. 1949, p. 285-296.

A study of the entire system from 0 to 100% Fe. Experimental vacuum furnace used for thermal analysis and solution quenching. Photomicrographs and X-ray diffraction patterns; phase diagrams.

4A-40. Neutron Diffraction Studies of Order-Disorder in Alloys. C. G. Shull and Sidney Siegel. *Physical Review,* ser. 2, v. 75, Apr. 1, 1949, p. 1008-1010.

Neutron-diffraction techniques were used to study order in the substitutional solid solutions FeCo, Ni_3Mn, and Cu_3Au. Superlattice effects were found in the first two examples, which are difficult to study by X-rays.

4B—Ferrous

4B-27. Nodular Graphite in Cast Iron. H. W. Lownie, Jr. *Metals Review,* v. 22, Mar. 1949, p. 5-8.

Surveys major metallurgical development destined for important engineering and industrial uses. Literature references throughout the text.

4B-28. Fortschritte in der Isolierung von Einschlussen und Gefugebestandteilen in legierten und unlegierten Stählen. (Progress in the Separation of Inclusions and Structural Constituents in Alloyed and Unalloyed Steels.) Paul Klinger and Walter Koch. *Stahl und Eisen,* v. 68, Sept. 9, 1948, p. 321-332; discussion, p. 332-333.

A process of isolating oxide inclusions; the types of oxide formed under different deoxidation conditions. The behavior of oxides during working of the steel was investigated. 21 ref.

4B-29. Progress in Separation Methods. P. Klinger and W. Koch. *Engineers' Digest,* v. 10, Feb. 1949, p. 50. Translated and condensed from *Stahl und Eisen,* v. 68, Sept. 9, 1948, p. 321-333.

See abstract of original item 4B-28.

4B-30. Neue Beiträge zur Kenntnis der Karbide in legierten Stählen. (New Contributions to Knowledge of the Carbides in Alloy Steels.) Walter Koch and Hans-Joachim Wiester. *Stahl und Eisen,* v. 69, Feb. 3, 1949, p. 73-79.

Results of experiments made to isolate the carbides in Mo, Ni, and Si steels as well as those in "temper-tough" and "temper-brittle" steels. Effects of transformation in its various stages on the composition of carbides; results of an X-ray investigation of isolated carbides. 19 ref.

4B-31. Untersuchungen uber die Ursache der Anlassbeständigkeit sonderkarbidhaltiger Stähle. (Research on the Cause for the Retention of Hardness by Special Carbide-Containing Steels.) Walter Koch and Hans-Joachim Wiester. *Stahl und Eisen,* v. 69, Feb. 3, 1949, p. 80-86.

The study was made with two steels, one containing 0.3% C and 2.1% V; the other, 1-12% Cr. Hardness retention was found to be connected with a certain composition of carbon and alloy element. 13 ref.

4B-32. Austenitic Centers of Primary Crystallization in Steel. (In Russian.) V. E. Neimark. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1445-1449.

A method of determination of the dimensions of austenitic centers of primary crystallization, influence of factors such as melting point, rate of crystallization, and additions of Al, Mo, Zr, V, Ti, Cb, and B. Relation between above and secondary austenitic grain-size.

4B-33. Solubility of Hydrogen in Molten Iron and Its Alloys With Titanium, Columbium, and Tantalum. (In Russian.) M. M. Karnaukhov and A. N. Morozov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Dec. 1948, p. 1845-1855.

The solution of hydrogen in molten iron was investigated, including the influence of temperature and pressure on solubility and the kinetics of the process. The possibility of the formation of hydrides by alloy elements thus forming more stable compounds is considered.

4B-34. Inoculation et graphite des fontes grises. (Inoculation and Graphite of Gray Cast Iron.) Albert de Sy. *Fonderie,* Jan. 1949, p. 1433-1444; discussion, p. 1444-1446.

Emphasis on the possibility of improvement of mechanical properties. The classical theory of superfusion and the dependence of the crystal structure of gray iron on this factor. Influence of other substances such as sulfur and phosphorus on properties and on distribution and form of the graphite.

4B-35. On Phase-Change Processes in Iron-Silicon Alloys. K. M. Guggenheimer and H. Heitler. *Transactions of the Faraday Society,* v. 45, Feb. 1949, p. 137-145.

Various phase-change processes in the solid state of the Fe-Si system which have been observed previously by measuring magnetic-saturation intensities as functions of temperature were studied with respect to their reaction kinetics. Quasi-monomolecular and bimolecular reactions were found and some activation energies determined.

4B-36. Beitrag zur Erforschung der schwarzen Stellen im Temperguss. (A Contribution to the Investigation of Black Spots in Malleable Iron.) Friedrich Vogel. *Die Neue Giesserei,* v. 36 (new ser., v. 2), Feb. 1949, p. 45-47.

A chemical study indicates that black spots are undoubtedly a reaction product of the silica of the molding sand and the molten iron or aluminum, provided they are not slag inclusions.

4B-37. Die Karbide in Eisen-Kohlenstoff-Silizium-Legierungen und Gusseisen. (The Carbides in Iron-Carbon-Silicon Alloys and in Cast Iron.) Friedrich Bischof. *Die Neue Giesserei,* v. 36 (new ser., v. 2), Feb. 1949, p. 51-52.

An experimental study of four different alloys. The greater instability of SiC over cementite in the annealed alloys.

4B-38. Wasserstoffgehalte flussigen Stahles verschiedener Herstellung. (Hydrogen Contents of Molten Steels Produced by Different Methods.) Hanns Wentrup, Herbert Fucke, and Otto Reif. *Stahl und Eisen,* v. 69, Feb. 17, 1949, p. 117-122.

The steels investigated were made in basic and acid openhearth furnaces and in the basic electric arc furnace. Method of sampling and analyzing the steels; the reasons for differences in the H-contents of different steels. The relation between flocculation number and hydrogen content. 16 ref.

4C—Nonferrous

4C-35. The Structure and Properties of the Alloy Cu_2MnIn. B. R. Coles, W. Hume-Rothery, and H. P. Myers. *Proceedings of the Royal Society,* ser. A, v. 196, Feb. 22, 1949, p. 125-133.

The ferromagnetic Heusler alloy Cu_2MnAl has a body-centered cubic structure with an ordered arrangement of the atoms. It was suggested that if the Al were replaced by In, the superlattice would be more stable. Such an alloy was prepared and was ferromagnetic in the as-cast state, and also after a variety of heat treatments. Results suggest that in the In alloy the critical value of R/r is being approached at which ferromagnetism will disappear. Reasons for supposing that the ferromagnetism is due to interaction between Mn atoms. 17 ref.

4C-36. Constitution of Sintered & Worked Titanium-Nickel Alloys. J. R. Long. *Metal Progress,* v. 55, Mar. 1949, p. 364-365.

Photomicrographs and tentative partial constitution diagrams.

4C-37. Superlattice Presence in Cu_3Au and FeCo Systems. Sidney Siegel and C. G. Shull. *U. S. Atomic Energy Commission,* AECD-2077, June 17, 1948, 3 pages.

Results of study using neutron diffraction.

4C-38. Investigation of Antimony-Cesium Layers by Means of an Electron Microscope. (In Russian.) A. I. Frimer. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Nov. 21, 1948, p. 255-257.

Technique for above investigation, characterized by the fact that the substance investigated can be kept under vacuum at all times. Several typical electron micrographs.

4C-39. X-Ray Investigation of the Structure of Nickel "Skeleton" Catalyst. (In Russian.) Yu. S. Terminasov and M. S. Beletskii. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Dec. 1, 1948, p. 411-413.

The residue remaining after leaching out the aluminum by means of a KOH solution from the compound Ni_2Al_3, that is, the nickel "skeleton" catalyst, represents dispersed crystals of nickel of hexagonal modification, in the crystal lattice of which is dissolved hydrogen.

4C-40. The Binary System Zirconium-Boron. (In English.) Roland Kiessling. *Acta Chemica Scandinavica,* v. 3, no. 1, 1949, p. 90-91.

Results of an X-ray study, giving unit-cell distances, lattice structures. Relationship with the Ti-B system.

4C-41. Untersuchungen an Zink-Sublimationskristallen. (Research on Zinc Sublimation Crystals.) D. Geist. *Acta Crystallographica,* v. 2, Mar. 1949, p. 13-14.

Zinc crystals grown by sublimation in air, in argon, or in vacuo were found to consist of stacks of plates parallel to the hexagonal basal plane. By direct microscopic and by interferometric measurement the thickness of these plates was shown to vary from 2μ down to less than 200 A.

4C-42. The Crystal Structure of Ni_4W. E. Epremian and D. Harker. *Journal of Metals,* v. 1, sec. 3, Apr. 1949, p. 267-273.

X-ray diffraction study of the beta phase. Photomicrographs in both quenched and aged conditions; hardness of the 19.8 atom % W alloy as a function of time and temperature of aging after quenching from 1150° C.; electrical resistivity data; and diffraction patterns.

4D—Light Metals

4D-24. Non-Metallic Inclusions in Magnesium-Base Alloys and the Flux-Refining Process. E. F. Emley. *Journal of the Institute of Metals,* v. 75, Feb. 1949, p. 431-480.

An investigation into behavior of inclusions in molten metal and the nature and function of the refining process. Physical properties of flux and ways of obtaining desirable properties and avoiding defects. Methods for detecting inclusions and for determining their origin by chemical, microscopic, and spectroscopic means. 28 ref.

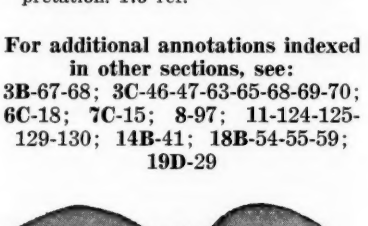
4D-25. Non-Metallic Inclusions in Magnesium-Base Alloys Containing Zirconium. E. F. Emley. *Journal of the Institute of Metals,* v. 75, Feb. 1949, p. 481-512.

Origin and behavior of these inclusions. Early work leading to the recognition of new types of chloride inclusions associated with zirconium-rich particles.

4D-26. Equilibrium Diagrams of Aluminum Alloys. W. L. Fink. *American Society for Metals,* "Physical Metallurgy of Aluminum Alloys," 1949, p. 1-92.

Methods by which these diagrams have been determined. Some of the diagrams which have been determined with sufficient accuracy and with sufficient completeness to justify consideration; and their interpretation. 173 ref.

For additional annotations indexed in other sections, see:
3B-67-68; 3C-46-47-63-65-68-69-70; 6C-18; 7C-15; 8-97; 11-124-125-129-130; 14B-41; 18B-54-55-59; 19D-29



5A—General

5A-20. Recent Developments in Powder Metallurgy. Supplement to "Powder Metallurgy—Its Physics and Production." Part I. Paul Schwarzkopf. *Powder Metallurgy Bulletin,* v. 4, Mar. 1949, p. 28-56.

Comprehensive classified review of new developments since publication of book in 1947. 183 ref.

5A-21. Fundamental Study, and Equipment for Sintering and Testing of Cermet Bodies. A. R. Blackburn, T. S. Shevlin, and H. R. Lowers. *Journal of the American Ceramic Society,* v. 32, Mar. 1, 1949, p. 81-98.

The theoretical aspects of fundamental chemistry experiments which accompanied the laboratory development of test specimens. Metal powders (Ni, Fe, Co, Cr, and Cr-B) were fired on pure Al_2O_3 tile in various controlled atmospheres. Special furnaces necessary for the fundamental study and for sintering cermet specimens. Equipment for determining instantaneous modulus of rupture and tensile rupture, and long-time stress-rupture in bending at temperatures up to 2400° F. 12 ref.

5A-22. Powder Metallurgy No Panacea. R. L. Ziegfeld and K. H. Roll. *Iron Age,* v. 163, Mar. 24, 1949, p. 68-71.

Admitting that powder metallurgy is not a cure-all for all production problems, the authors emphasize its advantages while critically evaluating its role in industry.

5A-23. Powder Metallurgy: Improved Technology Widens Application. G. J. Comstock, John D. Shaw, C. L. Clark, and W. V. Knopp. *Iron Age,* v. 163, Mar. 24, 1949, p. 72-74.

Recent developments, including hot pressing of alloy powders and application in the high-temperature-alloy field.

5A-24. How Ford Produces Parts From Metal Powders. E. E. Ensign. *Iron Age,* v. 163, Mar. 24, 1949, p. 76-80.

Methods and equipment, including the automatic restriking operation. Automatic machining of external grooves in certain types of bushings.

5A-25. Pressed Metal Powder Applications in the Automotive Industry. D. C. Bradley. *Iron Age,* v. 163, Mar. 24, 1949, p. 86-89.

Wide variety of powdered-metal parts used by General Motors Chrysler, and Ford.

5A-26. (Book) **Powder Metallurgy. Vol. I.** Claus G. Goetzel. 806 pages. Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. $15.00.

First of a three-volume work on the technology of metal powders and their products. It deals with methods of powder production, characteristics and properties of powders, the molding of powders into solid forms, hot pressing apparatus and techniques, sintering, heat treating, finishing treatments, and related subjects.

5A-27. (Book) **Poroshkovoe Metallovedenie.** (Powder Metallurgy.) M. Yu. Bal'shin. 332 pages. 1948. State Scientific-Technical Publishing House for Literature on Ferrous and Nonferrous Metallurgy, Moscow, U.S.S.R.

A handbook for production engineers, research workers, and students. Theoretical bases; methods of production in the USSR and abroad; physical and chemical processes taking place during the production; mechanical properties of finished products; and applications of individual products. 156 ref.

5B—Ferrous

5B-6. TV Parts Made by Powder Metallurgy. *Iron Age,* v. 163, Mar. 24, 1949, p. 74.

Method using iron powders for production of high-voltage transformer cores used in television deflection circuits.

5B-7. Physical Properties of Reduced Iron Powder Plus Graphite and Copper. George Stern. *Iron Age,* v. 163, Mar. 24, 1949, p. 81-85.

Results of an investigation in which mixtures of a commercial grade of reduced iron plus 0.40 to 1.05% graphite and 2 and 5% Cu were prepared, treated by means of a cycle considered commercially feasible, subjected to various standard steel heat treatments, and then studied for physical properties and microstructure.

5B-8. Magnetic Fluid Clutch Employs Iron Powder. *Iron Age,* v. 163, Mar. 24, 1949, p. 90.

The magnetic fluid contains carbonyl E iron powder, a silicone fluid, and polethylene glycol oleate.

5B-9. Die Grundlagen des Roheisen-Zunder-Verfahrens zur Herstellung von Eisenpulver. (The Principles of the Crude-Iron-Ignition Process for Producing Iron Powder.) Gerhard Naeser, Hermann Steffe, and Werner Scholz. *Stahl und Eisen,* v. 68, Sept. 9, 1948, p. 346-353.

New process consists of spraying molten iron-carbon alloys under controlled partial-oxidation conditions. The physicochemical and technical principles of the various operations; the constitution of the powder and its behavior during pressing and sintering. Experimental data. 18 ref.

5B-10. Prealloyed Steel Powders. George A. Roberts and Arthur H. Grobe. *Iron Age,* v. 163, Mar. 31, 1949, p. 78-79.

Initial plant production unit of Vanadium-Alloys Steel Co., which has been successfully used to produce a wide variety of metallic alloys having unusually good mechanical properties. The process consists of disintegrating a small molten metal stream through a zirconia nozzle by means of water jets. The powder is dewatered, dried, reduced, annealed, and screened. Potential applications.

5C—Nonferrous

5C-7. Brass Powder Parts in Toys. *Iron Age,* v. 163, Mar. 24, 1949, p. 71.

5C-8. Porous Metal Bearings. A. J. Langhammer. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 119-123; discussion, p. 136-137.

Fabrication, advantages, applications, and the various alloys used.

5C-9. Moraine Durex-100 Engine Bearings. J. A. Lignian. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 124-130; discussion, p. 136-137.

The Durex-100 bearing is a steel-backed, lead-base, babbitt-lined bearing, in which the bearing surface is supported by, and bonded to, a spongy, metallic base. These bearings are of the precision, interchangeable type used in connecting rods and main bearings, and in full-round, split-type bushings for camshaft bushings. Fabrication procedure and structures of the layer and the underlying base metal. A mechanical mixture of pure Cu and Ni powders is applied to the steel base by sintering.

For additional annotations indexed in other sections, see:
3C-72

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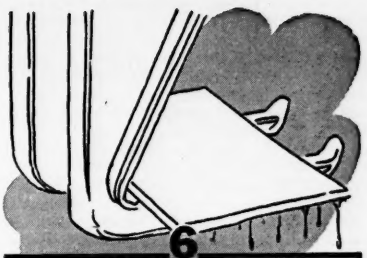

6 CORROSION

6A—General

6A-46. "Vapor Phase Inhibitor" Spells Product Protection. Newell Farrar. *Western Metals,* v. 7, Mar. 1949, p. 35-36.

Rust and corrosion inhibitor wrapping that eliminates grease, requires no special handling or application system, and is non-toxic yet offers full protection for periods up to five years for ferrous and aluminum stock or products.

6A-47. Corrosion of Metals; Microbiological Factors in Underground Corrosion. W. H. J. Vernon. *Chemical Age,* v. 60, Mar. 5, 1949, p. 355-357.

Summary of lecture before meeting of the Royal Society of Arts, London, Feb. 21, 1949.

6A-48. Some Aspects of Packaging in Metal Containers. R. K. Sanders. *Chemistry & Industry,* Mar. 5, 1949, p. 151-155.

Leakage, mechanical strength, corrosion, application of coatings, and design for ease of opening.

6A-49. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 41, Apr. 1949, p. 103A-104A.

Factors of time of exposure and temperature in pilot-plant corrosion testing.

6A-50. Verhalten "kohlenoxydfester" Werkstoffe gegenuber Wassergas bei extremen Bedingungen. (Behavior of "Carbon Oxide" Resistant Materials in Contact With Water Gas Under Extreme Conditions.) K. H. Ziesecke. *Chemie-Ingenieur-Technik,* v. 21, Jan. 1949, p. 15-18.

Twenty chromium steels and 6 nonferrous metals were studied at 1000 atm. and temperatures of 300-450° C. Industrial applications and experimental furnace design.

6A-51. Corrosion, Passivity and Passivation From the Thermodynamic Point of View. M. Pourbaix. *Corrosion,* v. 5, Apr. 1949, p. 121-133.

Translated from "Journées des Etats du Surface." 1946. See items 6A-40, 1949, and 6-204, 1947. 15 ref.

6B—Ferrous

6B-56. Causes of Flue Gas Deposits and Corrosion in Modern Boiler Plants. W. F. Harlow. *Engineer,* v. 187, Mar. 11, 1949, p. 271-273; discussion, p. 277-279. A condensation.

Universal nature of the problem, which, however, is much less serious in pulverized-coal installations. The most important cause of corrosion is the formation of SO_3 and resulting H_2SO_4 on passage of flue gases over heated boiler surfaces, especially at the higher temperatures. The test apparatus; effects of various factors including sulfur and impurity content; practical means of minimization.

6B-57. Corrosion: Surface Protection of Iron and Steel. *Iron and Steel,* v. 22, Mar. 1949, p. 93.

Detel Metal Undercoat invented by F. C. Dyche-Teague, England. The protective action does not depend on the medium or bonding material used, but on the pigment itself.

6B-58. Gas Cylinders. *Iron and Steel,* v. 22, Mar. 1949, p. 95.

Recent work on corrosion and its prevention. German research; references to original German publications.

6B-59. Oxidation of Turbine Oils in the Laboratory. D. Wyllie and G. C. N. Cheesman. *Journal of the Institute of Petroleum,* v. 35, Jan. 1949, p. 61-72.

The behavior of typical oils during a standard oxidation test was observed both under standard conditions and using a modified test. The oxidation-corrosion test of Pope and Hall was shown to be unsuitable for turbine oils, and the use of interfacial tension as a criterion of the extent of oxidation is not advised.

6B-60. Basic Principles of Corrosion Control by the Use of Lime. Edward S. Hopkins. *Technical Association Papers* (TAPPI), ser. 31, June 1948, p. 399-402.

Corrosion of iron and steel water pipe as a function of dissolved oxygen. Neutralization of free CO_2 in low alkaline waters by lime and the subsequent precipitation of a calcium carbonate-ferric oxide coating on pipe surfaces to retard corrosion. Cost of treatment and apparatus. 11 ref.

6B-61. The Use of Inhibitors for Controlling Metal Corrosion. Part III. Chromate and Dichromate Inhibitors. Part IV. Miscellaneous Inhibitors. G. T. Colegate. *Metallurgia,* v. 39, Feb. 1949, p. 219-221, Mar. 1949, p. 263-265.

Application and consumption. In part IV: use of silicates, phosphates, sodium nitrite and vapor phase inhibitors. Use of more than one inhibitor, and inhibitors used in acid pickling of steel.

6B-62. Korrosion und mechanische Beanspruchung. (Corrosion and Mechanical Wear.) Erich Gerold. *Metalloberfläche,* v. 3, Feb. 1949, p. 29-32.

Reciprocal effects of corrosion and mechanical wear in steels.

6B-63. Der Oberflächenschutz der Metallteile in der Superphosphatindustrie. (The Surface Protection of Metal Parts in the Super-Phosphate Industry.) A. Kufferath. *Metalloberfläche,* v. 3, Feb. 1949, p. 40-42.

Proposes methods of increasing the resistance of metal parts to corrosive and abrasive wear.

6B-64. Korrosion und Korrosionsschutz von Eisen und Stahl in Bergwerksschächten. (Corrosion of Iron and Its Prevention in Mine Shafts.) Franz Eisenstecken. *Stahl und Eisen,* v. 68, Apr. 22, 1948, p. 164.

An investigation covering ten different types of steel and four of cast iron and the protecting effect of alloying elements and of coatings.

6B-65. Causes of Flue Gas Deposits and Corrosion in Modern Boiler Plants. W. F. Harlow. *Combustion,* v. 20, Mar. 1949, p. 35-39. A condensation.

See abstract of condensed version in *Engineer,* item 6B-56, 1949.

6B-66. Corrosion Phenomena in Connection With Steel Pressure Cylinders Used for Storage and Transport of Coal Gas. *Metallurgia,* v. 39, Mar. 1949, p. 284.

Some recent German work.

6B-67. The Corrosion of Heating Surfaces in Boiler Plants: Further Studies in Deposit Formation. J. R. Rylands and J. R. Jenkinson. *Institution of Mechanical Engineers, Proceedings,* v. 158, no. 4, 1948, p. 405-414; discussion, p. 414-425.

Preliminary laboratory tests showed a pronounced difference in behavior of cast iron and steel under the corrosive attack of the sulfur acids occurring in boiler gases. The inherent corrosion resistant properties of cast iron over a wide range of conditions are shown to be linked with its Si content. The puzzling "band corrosion" of air-heaters is shown to be a temperature and acid-concentration phenomenon.

6B-68. Effect of Various Aqueous Solutions Upon the Reactions at Pure Iron Anodes and Cathodes. Part I. W. W. Kittelberger and A. C. Elm. *Corrosion,* v. 5, Apr. 1949, p. 101-112.

Theoretical principles and results of extensive experimental investigation for the purpose of developing a method which would not only indicate when a metal is passive, but would also afford a means of measuring the "inhibitive power" of an environment. A method of this sort also should be applicable to measurement of the "corrosiveness" of noninhibitive solutions. Procedure and equipment. (To be concluded.)

6B-69. New Aspects of Rustproofing. Arthur Minich. *Paint, Oil and Chemical Review,* v. 112, Apr. 14, 1949, p. 42, 44, 46, 48.

Electrochemical aspects and limitations of rigid coatings. Different test methods used to evaluate a rustproofing agent known as "Nuodex Compound X-545"; results of its use under various conditions.

6C—Nonferrous

6C-17. Measurements on the Oxidation-Resistance of High-Melting-Point Alloys. O. Kubaschewski and A. Schneider. *Journal of the Institute of Metals,* v. 75, Feb. 1949, p. 403-416.

Resistance to atmospheric oxidation of binary and ternary alloys was investigated at 1250° C. by means of special apparatus. X-ray and microscopic examinations and Brinell hardness measurements were also carried out, at room temperature, on alloys of chromium with tungsten and molybdenum. 12 ref.

6C-18. Oxidation-Resistance and Some Phase Relationships in the System Chromium-Tantalum-Nickel. O. Kubaschewski and H. Speidel. *Journal of the Institute of Metals,* v. 75, Feb. 1949, p. 417-430.

Investigation using thermal, microscopic, and X-ray methods. Results of high-temperature oxidation tests on the systems Ni-Ta and Cr-Ta-Ni.

6C-19. Korrosionsuntersuchungen an Hartchromschichten. (Corrosion Tests on Hard Chromium Deposits.) Walter Eilender, Heinrich Arend, and Franz Sadrazil. *Metalloberfläche,* v. 3, Feb. 1949, p. 32-35.

The resistance of hard Cr is caused by its air passivation. Effects of surface condition, heat treating, nitrite, paraffin, and phosphate baths (both before and after the chromium plating operation) on the corrosive properties of Cr.

6C-20. Sur la dissolution du platine laminé dans l'eau régale. (Concerning the Dissolution of Platinum Foil in Aqua Regia.) Clément Courty. *Bulletin de la Société Chimique de France,* Nov.-Dec. 1948, p. 1152-1154.

Silver, gold, iridium, and copper impurities in polished platinum foil produce curious phenomena in the dissolution of the foil in aqua regia. Data concerning rates of dissolution.

6C-21. Corrosion of Base Metal Contact Surfaces in the Telephone System. *Corrosion,* v. 5, Apr. 1949, p. 134.

Method for minimizing this corrosion by use of a special lubricant composition. Comparative results with and without treatment.

6D—Light Metals

6D-12. Some Factors Influencing the Corrosion Resistance of Aluminum. E. G. West. *Metallurgia,* v. 39, Feb. 1949, p. 210-214.

Recent trends toward a better understanding and some new means of protection. 20 ref.

6D-13. Beobachtungen uber den Einfluss der Walz- und Gluhbedingungen auf die Spannungskorrosions-beständigkeit von Blechen aus Aluminium-Zink-Magnesium-Legierungen. (Observations on the Effect of Rolling and Annealing Conditions on the Stress-Corrosion Resistance of Sheets of Aluminum-Zinc-Magnesium Alloys.) Walter Bungardt. *Metalloberfläche,* v. 2, July 1948, p. 137-140.

Above was studied for a series of Al-base alloys. The 1-mm. sheets studied included a group with and a group without vanadium.

6D-14. Dissolution of Aluminum in Sodium Hydroxide Solutions; Effect of Gelatin and Potassium Permanganate. Michael A. Streicher. *Industrial and Engineering Chemistry,* v. 41, Apr. 1949, p. 818-819.

Dissolution of commercially pure Al (99.2%) in 0.30 N NaOH at 23° C. was modified by addition of the above substances. 0.50% gelatin reduced weight loss by 50%. When potassium permanganate was added in quantities below 0.06%, there was an increase in weight loss. 0.10% was necessary to decrease weight loss. A mechanism is suggested for the action of these inhibitors. 10 ref.

6D-15. Magnesium Alloy Protection by Selenious Acid-Dichromate Solutions. L. Whitby. *Metallurgia,* v. 39, Mar. 1949, p. 233-240.

The standard selenious acid treatment has the disadvantages that fatigue strength is reduced and that on certain alloys adhesion is poor. Results of an investigation of the influence of sodium dichromate additions to the selenious acid bath.

6D-16. Surface Treatment and Finishing of Light Metals. Part II. Corrosion and Protection of Aluminium and Its Alloys. S. Wernick and R. Pinner. *Sheet Metal Industries,* v. 26, Apr. 1949, p. 805-810, 823.

Literature on corrosion, including effects of alloy constituents, impurities, dissimilar-metal inserts, cladding, and variations in heat treatment procedures. Intergranular and stress corrosion. (To be continued.)

For additional annotations indexed in other sections, see:

3C-57-62

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7 CLEANING and FINISHING

7A—General

7A-41. Finishing Royal Typewriters in Wrinkle Enamel. L. E. Marsden. *Industrial Finishing,* v. 25, Mar. 1949, p. 26-28, 31-32.

Surface preparation, masking, glazing, spraying, and baking for wrinkle finish.

7A-42. Coating and Finishing With Automatic Spraying Equipment. Part II. Frank V. Faulhaber. *Organic Finishing,* v. 10, Mar. 1949, p. 9-12.

Equipment and procedures.

7A-43. Blast Cleaning Equipment Design. J. F. Farrell. *Organic Finishing,* v. 10, Mar. 1949, p. 15-16, 18-19.

Describes, illustrates, and diagrams the various types.

7A-44. Moisture-Resistant Coatings for Metal. William F. Singleton and William C. Johnson. *Industrial and Engineering Chemistry,* v. 41, Apr. 1949, p. 749-753.

Data for a range of polymeric coatings with respect to permeability, adhesion to certain metals, and moisture resistance under alkaline conditions. Selected coatings were pigmented to determine the effect of type and concentration of pigment.

7A-45. Sodium Silicates in Metal Cleaning. Clinton W. MacMullen and Clarence G. Ozar. *Metal Finishing,* v. 47, Apr. 1949, p. 52-54.

Properties and applications; advantages.

7A-46. Synthetic Surface-Active Agents in Metal Finishing. Georgia Leffingwell. *Metal Finishing,* v. 47, Apr. 1949, p. 68-70.

Recent developments in uses for electroplating, wire-pickling baths, corrosion prevention and rust inhibitors, cutting and grinding oils, and metal cleaners.

7A-47. Eigenschaften gespritzter Metalluberzuge. (Properties of Sprayed Metal Coatings.) I. H. Reininger. *Metalloberfläche,* v. 2, Sept. 1948, p. 185-192.

Specific weights, densities, porosities, and electrical conductivities of sprayed metal coatings on different metals. Structures of different types of coatings. 25 ref.

7A-48. Die pyrolytische Plattierung von Kupfer, Eisen und Stahllegierungen mit Molybdän, Wolfram und Chrom. (Pyrolytic Plating of Copper, Iron, and Steel Alloys With Molybdenum, Tungsten, and Chromium.) Edmund R. Thews. *Metalloberfläche,* v. 2, Sept. 1948, p. 193-196.

The above is based on the carbonyl process of depositing metals. Plating method; advantages and disadvantages, generator and plating plant, mechanical defects, and adhesiveness of the platings.

7A-49. The Lustron Home. Part II. Ezra A. Blount. *Products Finishing,* v. 13, Apr. 1949, p. 22-34, 36.

Enameling processes involved in making the factory-built housing unit.

7A-50. Barrel Finishing of Metal Products. Part 28. Barrel Finishing in England; The Edmonds Burnishing Barrel. H. Leroy Beaver. *Products Finishing,* v. 13, Apr. 1949, p. 50, 52, 56, 58, 62, 66, 68.

History of development.

7A-51. Chemical Surface Treatments for Metals. A. E. Durkin. *Tool Engineer,* v. 22, Apr. 1949, p. 22-25.

Alkaline cleaning, vapor degreasing, rust and scale removers, black oxide treatments of steel, and phosphate coatings. This installment deals only with general principles and equipment and application to steels. (To be concluded.)

7A-52. Preparing Surfaces for Metallizing by Blast Cleaning. Rick Mansell. *Machinery,* v. 55, Apr. 1949, p. 165-168.

Selection of blasting abrasive, air volume and pressure required, and removing surface oil and grease from part to be metallized. Suggestions on blasting technique.

7A-53. Ceramic Coated Metals for Aircraft Power Plant Applications. R. A. Jones. *Better Enameling,* v. 20, Apr. 1949, p. 26-27, 29.

Development work of Army's Air Materiel Command.

7A-54. Liquid Blasting Cleans and Finishes Metallic and Nonmetallic Surfaces. B. H. Marks. *Materials & Methods,* v. 29, Apr. 1949, p. 64-67.

Surface blasting with a high-velocity stream of abrasive particles suspended in liquid provides an economical means of deburring, descaling, and preparing surfaces for finishes. Equipment and procedures.

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7B—Ferrous

7B-58. The Modern Porcelain Enamel Research Laboratory. G. H. Spencer-Strong. *Finish,* v. 6, Apr. 1949, p. 37-38, 73.

Laboratory of Pemco Corp., Baltimore.

7B-59. Automatic Paint Booth Gives Steel Barrel Manufacturer "Pushbutton" Operating Advantages. *Steel,* v. 124, Mar. 28, 1949, p. 82, 98, 101.

Installation and operation of booth.

7B-60. Preparing Cast Iron Surfaces for Bonding. J. H. Shoemaker. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 199-205; discussion, p. 205-207.

General methods. Two new processes developed by Kolene Corp. are the molten-salt-bath and the electrolytic molten-salt-bath methods. Structure of the bond obtained.

7B-61. Beizen, Atzen, Vorbehandeln, Entrosten und Rostschutzmittel. (Pickling, Etching, Pretreating, Rust Removal, and Rust Preventives.) II and V. Richard Springer. *Metalloberfläche,* v. 2, Sept. 1948, p. 199-203; v. 3, Feb. 1949, p. 45-50.

Reviews patent and other literature for the years 1935 to 1943.

7B-62. Mechanical Aspects of Pipe-Line Coatings. L. F. Sherer and O. C. Mudd. *Oil and Gas Journal,* v. 47, Mar. 31, 1949, p. 119-122.

Properties of various types, service results, recent developments, application procedures, and pipe preparation for coating.

7B-63. Finishing Automobile Components at the Kaiser-Frazer Plant. III. (Concluded.) *Industrial Heating,* v. 16, Mar. 1949, p. 480-482, 484.

Operations and equipment for finishing fenders, hoods, grilles, wheels, and other small parts.

7B-64. Vitreous Enamelling in White and Pastel Colours Without a Groundcoat. *Electroplating and Metal Finishing,* v. 2, Mar. 1949, p. 187-188.

Use of zirconium steel as a solution to the above problem.

7B-65. Effect of Temperature on the Rate of Blister Failure of Finishes on Steel in Water Immersion Tests. J. A. Boylan and R. I. Wray. *ASTM Bulletin,* Mar. 1949, p. 53-55.

Data obtained during cooperative test program. Temperatures of 100, 110, and 120° F. were used.

7B-66. Clad Steel Plate. F. R. Pattison. *Metallurgia,* v. 39, Mar. 1949, p. 269-271.

Various fabrication methods, properties, and applications.

7B-67. Special Oxide Film on Steel Provides Electrical Insulation. P. L. Schmidt. *Materials & Methods,* v. 29, Apr. 1949, p. 54-56.

See abstract from *Electrical Engineering,* item 7b-109, 1948.

7B-68. Houses for the Homeless. *Production Engineering & Management,* v. 23, Apr. 1949, p. 57-64.

Plant layouts and processes from the time raw material arrives until fabricated parts are loaded, used by Lustron, makers of enameled-steel prefabricated homes.

7B-69. The Production of the Industry's Only All-Porcelain Automatic Clothes Washer. *Better Enameling,* v. 20, Apr. 1949, p. 8-16.

Forming, pickling, enameling, firing, assembly, and inspection operations.

7B-70. Trouble Shootin'. John L. McLaughlin. *Better Enameling,* v. 20, Apr. 1949, p. 36-37.

Enamel defects known as spongy texture and fishscale. Recommended remedies.

7B-71. Chemical Scuff Resistant Coatings for Ferrous Parts. George Black. *Product Engineering,* v. 20, Apr. 1949, p. 138-141.

Test and performance data on manganese iron phosphate, iron oxide, and iron sulfide coatings, with respect to effectiveness, application, and ease of production.

7B-72. Modern Porcelain Enameling. Chapter III. Part II. (Continued.) Alexis J. Hannan and Lee R. Fuller. *Ceramic Industry,* v. 52, Apr. 1949, p. 91-93.

Metal-preparation equipment, solutions, and procedures. Mechanical and chemical methods, and use of bright annealing to replace conventional methods. (To be continued.)

7B-73. How to Prevent Defects in Porcelain Enameling Holloware. Part IX. Application—Streaks and Rundowns. F. A. Petersen. *Ceramic Industry,* v. 52, Apr. 1949, p. 96-97.

Practical recommendations.

7B-74. Porcelain Enamel Process Defects—Causes and Possible Cures. Part IX. Pits and Scumming. M. E. McHardy. *Ceramic Industry,* v. 52, Apr. 1949, p. 98.

7B-75. Porcelain Enameling at Lustron. E. E. Howe. *Iron Age,* v. 163, Apr. 14, 1949, p. 72-75.

Equipment and procedures of world's largest porcelain enameling installation. Because of the low firing temperature, enameling of regular auto-body stock rather than premium-quality enameling iron has proved practical.

7C—Nonferrous

7C-13. Chemical Colouring; Reactions Involving Liberation of Sulphur, Selenium and Tellurium. M. C. N. Holt and A. M. Ward. *Metal Industry,* v. 74, Mar. 11, 1949, p. 186-188.

Changes in color of metal surfaces when immersed in sodium thiosulfate and lead acetate solutions. Various acids were tried, the initial experiments being made with brass. A range of colors was also produced on copper, type metal, and silver.

7C-14. Vitreous Enameling of Aluminium and Aluminium Alloys—A Critical Study. J. C. Bailey and Marjorie E. Whitaker. *Light Metals,* v. 12, Mar. 1949, p. 139-154; commercial appraisal, p. 154-159.

Reviews knowledge and practices; properties and test results.

7C-15. The Influence of Crystal Face in the Catalytic Deposition of Cobalt on a Single Crystal of Copper. Henry Leidheiser, Jr., and Richard Meelheim. *Journal of the American Chemical Society,* v. 71, Mar. 1949, p. 1122-1124.

Results show that the rate of the chemical deposition from solution of one metal on a crystal of another differs with the face exposed at the surface. An explanation for the results is proposed on the basis of interatomic distances. Monocrystalline spheres of copper were mechanically and electrolytically polished. They were immersed in potassium formate solutions of a cobalt salt at 180-250° C. and cobalt was catalytically deposited on the surface. The greatly different catalytic activities of the various faces were indicated by a pattern on the surface.

7C-16. Finishing Monel Metal. Edward Rosen. *Metal Finishing,* v. 47, Apr. 1949, p. 60-65.

Mechanical and chemical procedures, including recipes for the various solutions used.

7C-17. Tin Plating by Immersion Solves Difficult Problem. *Metal Finishing,* v. 47, Apr. 1949, p. 66-67.

Process for tin coating the insides of copper water tubing.

7C-18. Automatic Metal Spraying; Protection of Constructional Steelwork by Aluminum. *Metal Industry,* v. 74, Mar. 18, 1949, p. 206-207.

Machine and process used. Results obtained.

7C-19. Improved Corrosion Resistance and Paint Adherence. *Die Castings,* v. 7, Apr. 1949, p. 59-60.

Chromate finish, developed during the war to permit use of zinc die castings in tropical climates or salt atmospheres, which gives a good paint base while improving surface characteristics.

7C-20. Varnishing of Zinc Surfaces. George Reich and Edmund R. Thews. *Paint and Varnish Production Manager,* v. 29, Apr. 1949, p. 91-92, 94-95.

The various methods, including pre-treatments. Recommendations.

7C-21. High-Temperature Ceramic Coatings for Molybdenum. *Better Enameling,* v. 20, Apr. 1949, p. 6-7. A condensation of a paper by D. G. Moore, L. H. Bolz, and W. N. Harrison.

See abstract of *National Advisory Committee for Aeronautics.* Technical Note No. 1626, item 7c-30, 1948.

7D—Light Metals

7D-16. Le brunissage au tonneau des pieces en alliages d'Aluminium. (Barrel Tumbling of Aluminum-Alloy Objects.) (Concluded.) Charles Etienne. *Revue de l'Aluminium,* v. 26, Feb. 1949, p. 65-69.

Several methods for decreasing or eliminating defects occurring during treatment.

7D-17. Priming Paints for Light Alloys. J. G. Rigg and E. W. Skerrey. *Paint Manufacturer,* v. 19, Mar. 1949, p. 77-83.

Previously abstracted from *Journal of the Institute of Metals.* See item 7d-46, 1948.

7D-18. Oberflächenbehandlung von Aluminium. (Surface Treatment of Aluminum.) F. Solar. *Schweisstechnik,* v. 2, Sept. 1948, p. 113-116.

Different methods of treating the surfaces of welded Al articles, to improve their appearance and their resistance to mechanical, chemical, or electrical influences.

7D-19. Surface Treatment and Finishing of Light Metals. Part I. Development of Light Metals: Their Application and Finishes. (Concluded.) S. Wernick and R. Pinner. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 585-593.

Choice of alloy and finish for protection and decoration; and applications of light metals. Physical and mechanical properties of the principal British wrought-Al alloys. 139 ref. (To be continued.)

For additional annotations indexed in other sections, see:
6B-64; 6D-16; 8-76; 11-136; 18B-65; 22D-26

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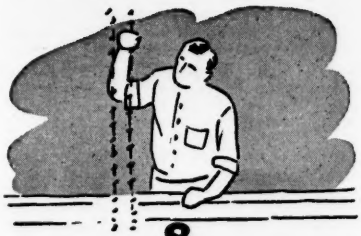


8

ELECTRODEPOSITION and ELECTROFINISHING

8-75. Improved Electrolytes for the Anodic Polishing of Certain Metals. P. A. Jacquet. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 577-584. A condensation.

Improved electrolytes developed for polishing of steels, light alloys, and chromium. An acetic-perchloric mixture is primarily for metallographic purposes; optimum conditions established experimentally and treatment after polishing. For polishing Al-Mg-Zn alloys, a phosphoric-chromic acid mixture proved most suitable. 18 ref.

8-76. Plating and Pickling Beryllium-Copper Components. E. E. Halls. *Metallurgia,* v. 39, Feb. 1949, p. 181-186.

Oxide films formed during heat treatment are more difficult to remove by pickling than are those on most copper alloys. Details of a suitable procedure. Electrodepositing of various metals on beryllium-copper for corrosion protection, soldering assistance, and high-frequency conductivity.

8-77. Cathode Sputtering Grows as Plating Method. Thomas A. Dickinson. *Western Metals,* v. 7, Mar. 1949, p. 30-31.

Electrical method of applying various types of metallic films to surfaces that are usually nonmetallic in order to facilitate the manufacture of telescope reflectors, spectrometers, phonograph master records, and many similar products. It is considered superior to electroplating and alloy-spray processes when the materials are not electrochemically compatible and when extremely thin metal layers must be permanently applied without special binding mediums.

8-78. Principles of Electroplating. H. E. Linsley. *American Machinist,* v. 93, Mar. 24, 1949, p. 107-122.

Prepared for the metalworking executive whose interest in electroplating concerns only the broad aspects of the process. General methods and equipment involved in production plating of the commoner materials.

8-79. Electroplated Bearings. Ralph A. Schaefer. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 189-198; discussion, p. 205-207.

Properties of the various types, applications, and procedures. 24 ref.

8-80. A Spiral Contractometer for Measuring Stress in Electrodeposits. Abner Brenner and Seymour Senderoff. *Journal of Research of the National Bureau of Standards,* v. 42, Feb. 1949, p. 89-104.

Instrument entails electrodeposition of a metal coating on the outside of a metal helix and measurement of change in radius of curvature of the helix induced by stress in the electrodeposit. Formulas for the calculation of stress; sources of error and correction factors. Reproducibility of measurements and validity of the results. 21 ref.

8-81. Calculation of Stress in Electrodeposits From the Curvature of a Plated Strip. Abner Brenner and Seymour Senderoff. *Journal of Research of the National Bureau of Standards,* v. 42, Feb. 1949, p. 105-123.

Simplified formulas are derived from the fundamentals of the theory of elasticity. Correction factors for a number of variables and specific formulas for different experimental procedures.

8-82. Défauts d'oxydation anodique dus a la présence de chlorures. (Defects in Anodic Oxidation Caused by the Presence of Chlorides.) Jean Herenguel and Roger Segond. *Revue de l'Aluminium,* v. 26, Feb. 1949, p. 52-54.

Results indicate that chlorides cause important distrubances in the mechanism of anodic oxidation to chlorine ions, diffusing deeply into the oxide layers. Methods for avoiding the presence of chlorides in treated surfaces and in the electrolytic bath.

8-83. True Crystallochemical Theory of the Growth of Crystals During Electrolysis. (In Russian.) K. M. Gorbunova and P. D. Dankov. *Uspekhi Khimii* (Progress in Chemistry), v. 17, Nov.-Dec. 1948, p. 710-732.

Importance of crystallochemical, passivation, concentration, and hydrodynamic factors on the mechanism of the process of deposition of metals during electrolysis. Consideration of these factors permits development of the new theory of variation of electrode potential and discharge voltage during these processes. 31 ref.

8-84. Die Gasgehalte von Hartchromschichten bei der Abscheidung aus schwefelsauren Bädern. (The Gas Content of Hard-Chromium Plating Deposited From Sulfuric Acid Baths.) Walter Eilender, Heinrich Arend, and Eugen Schmidtmann. *Metalloberfläche,* v. 2, July 1948, p. 141-143.

Effect of electroplating conditions on the absorption of hydrogen and oxygen by the hard-chromium deposit. Results show that gas absorption increases with current density and decreases with temperature. Conditions for low-gas Cr-deposits.

8-85. Practical Aspects of Plating in the Spoon and Fork Trade. F. R. Hill. *Journal of the Electrodepositors' Technical Society,* v. 24, 1948, p. 57-78. (Preprint.)

See abstract from *Electroplating and Metal Finishing,* items 8-39 and 8-60, 1949.

8-86. Large-Scale Electroplating Operations Combine Automatic and Bulk Processing. C. R. Fischrupp. *Steel,* v. 124, Apr. 4, 1949, p. 102-106.

Procedures involving use of full automatic and barrel equipment for zinc, nickel, and chromium plating of parts for telephone central-office switching apparatus.

8-87. Surface Preparation by Electropolishing. Charles L. Faust. *Journal of the Electrochemical Society,* v. 95, Mar. 1949, p. 62C-72C.

Previously abstracted from "Pittsburgh International Conference on Surface Reactions," 1948. See item 8-47, 1949.

8-88. Plating Home Appliances at Dazey Corp. Frank Bradley. *Metal Finishing,* v. 47, Apr. 1949, p. 49-51, 59.

Equipment and procedures. Pretreatments and non-electrolytic finishing processes.

8-89. Electropolishing Silver at Oneida, Ltd. Daniel Gray. *Metal Finishing,* v. 47, Apr. 1949, p. 55-59.

General theory and practice; practical adaptations.

8-90. Influence du polissage électrolytique sur les phénomenes de frottement et d'usure. (Influence of Electropolishing on the Phenomena of Wear and Friction.) Robert Mondon. *Revue de Métallurgie,* v. 45, Dec. 1948, p. 521-524.

Investigated for a Ni-Cr-Mo annealed steel, a Ni-Cr-Mo semi-hard steel, and a Cr-Mo nitrided steel. Advantages for electropolishing of machine parts subject to friction. On structural steels, such treatment had little effect.

8-91. Periodic Phenomena During Electrodeposition of Metals. (In Russian.) A. T. Vagramyan. *Zhurnal Fizicheskoi Khimii* (Journal of Physical Chemistry), v. 22, Dec. 1948, p. 1496-1504.

A new method permitting accurate recording of the periodic fluctuation of potential with time. Such periodic fluctuation indicates four basic steps characterizing the processes occurring during the corresponding time intervals. 15 ref.

8-92. Control of Electroplating Solutions by Analysis and Observation. VII. The Control of Zinc Cyanide Solutions. K. E. Langford. *Electroplating and Metal Finishing,* v. 2, Mar. 1949, p. 143-144, 188.

Analytical methods for Zn, NaCN, and NaOH.

8-93. Electroplating in Spain. I. Commercial Considerations. II. Technical Considerations. III. The Rise and Present Position of Electroplating in Spain. Vincente Massuet Grau. **IV. Some Aspects of Electrodeposition in Spain.** J. Aguillo Marly and J. B. Vericat Raga. **Part V. Solutions and Techniques in Use at Marconi Espanola S.A.** *Electroplating and Metal Finishing,* v. 2, Mar. 1949, p. 145-160, 165-180.

Individual companies are listed and their activities described. (Parts I, II, and V are anonymous.)

8-94. Iodometric Determination of Glucose. *Electroplating and Metal Finishing,* v. 2, Mar. 1949, p. 184.

Simple method by which the glucose content of a plating bath can be readily determined.

8-95. Electrodeposition in Electrotyping Practice. *Electroplating and Metal Finishing,* v. 2, Mar. 1949, p. 195-198. Condensed from paper by P. B. Upton.

Recent work on Ni and Fe deposition in the printing industry, giving recommended solutions and conditions. 10 ref.

8-96. The Effect of Heat on Electro-Deposited Chromium. R. Graham, K. R. Williams, and R. W. Wilson, *Engineering,* v. 167, Mar. 18, 1949, p. 241-243; Mar. 25, 1949, p. 265-267.

Results of experimental work between 100 and 450° C. to determine the factors, other than poor adhesion, responsible for cases in which satisfactory wear resistance in the internal combustion engine was not obtained. No attempt was made to determine internal stresses, but superimposition of a.c. and d.c. during plating was tried unsuccessfully in an attempt to decrease stress and produce a discontinuous surface. Apparatus and procedure.

8-97. Grain Orientation in Nickel Plate as Related to Brightness: An X-Ray Diffraction Study. William Smith, James H. Keeler, and Harold J. Read. *Plating,* v. 36, Apr. 1949, p. 355-361.

Results show clearly that there is no over-all relation between preferred orientation (fibering) and brightness of nickel plate under the conditions considered. 20 ref.

8-98. Porosity of Electrodeposited Metals. IV. Measurement of Very Low Porosities by the Low Pressure-Constant Overpressure Method. N. Thon,

Denis Kelemen, and Ling Yang. *Plating*, v. 36, Apr. 1949, p. 362-363, 366.

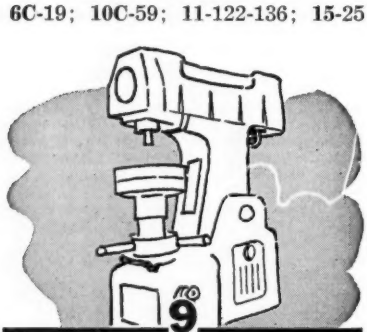
The crystal structure of nickel deposits can have a profound effect on their intrinsic porosity—porosity present in deposits free from visible pores and pits. Results were obtained by means of a newly devised technique, the constant over-pressure method. It is shown that the permeability constant, the numerical measure of porosity, is the same whether calculated by the constant over-pressure method or the previously reported low-pressure equalization method.

8-99. Book. **Metal Coatings Produced by Electrolytic and Chemical Means and the Coloring of Metals.** Ed. 3. (In German.) Eugen Werner, 185 pages. 1948. Carl Hanser Verlag, Munich, Germany. 5.50 Deutsche Mark.

Principal processes, including reference to pretreatments. A final chapter gives advice on the lay-out and equipment of plating shops and describes plant for sand blasting, pickling, rinsing, and polishing.

For additional annotations indexed in other sections, see:

6C-19; 10C-59; 11-122-136; 15-25



9-106. Prufung von Platinen fur Tiefziehbleche nach dem Verwindeversuch. (Testing Bar Stock for Deep-Drawing Sheet by Twisting.) Fritz Eisenkolb. *Stahl und Eisen*, v. 68, Jan. 29, 1948, p. 43-46.

Proposes a quick and reliable method of testing samples of rectangular steel bars which will reveal all internal defects, such as piping, slag inclusions, and cracks.

9-107. Zur Mechanik des Zugversuchs. (The Mechanics of the Tensile Test.) *Stahl und Eisen*, v. 68, Sept. 9, 1948, p. 361.

The relationships of longitudinal, radial, and tangent stresses, reduction in area, and stress equilibrium by means of which the flow curve for a series of materials was determined.

9-108. Method of Testing Fatigue of Steel Samples at High Temperatures. M. F. Sichikov and Z. D. Vishnevecky. *Engineers' Digest*, v. 10, Feb. 1949, p. 46. Translated and condensed from *Zavodskaya Laboratoria* (Factory Laboratory), Jan. 1948, p. 86-91.

Apparatus for determining fatigue of cylindrical test pieces at temperatures up to 600° C. while revolving at speeds of 5000 r.p.m. and above. An important feature is the mode of temperature determination.

9-109. Wanted: Better Criteria for Turbine Alloys. W. O. Sweeny. *Metal Progress*, v. 55, Mar. 1949, p. 315-318.

Limitations of present mechanical-test methods for the high-temperature alloys and fields where further investigation would be likely to be profitable. Further work on fundamental metallurgy as well as on test methods is considered desirable.

9-110. L'essai de fatigue sous charge progressive. Une nouvelle technique d'essai des matériaux. (Fatigue Testing Under Progressive Loading. A New Technique for Testing of Materials.) E. Marcel Prot. *Revue de Métallurgie*, v. 45, Dec. 1948, p. 481-489; discussion, p. 489.

Proposes method applicable to both metals and nonmetals, to a variety of tests and to any shape of test specimen. Theoretical bases and an apparatus for rotary-bending fatigue testing.

9-111. Choix de la forme d'entaille dans l'essai de résilience. (Selection of Notch Type for Impact-Strength Testing.) (Concluded.) J. Pomey, A. Cadilhac, and R. Coudray. *Revue de Métallurgie*, v. 45, Dec. 1948, p. 525-540.

As a result of experimental and theoretical investigation, a new type of notched test specimen was developed which is shown to give superior results.

9-112. Methods for Accelerated Testing of Cast High-Speed Steel. (In Russian.) I. R. Ushevskii. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Dec. 1948, p. 19-20.

New method consisting of determination of the mechanical properties of steel and its cutting ability.

9-113. Equipment for Determination of the Plasticity of Metal. (In Russian.) I. K. Antsiferov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1486-1488.

Existing apparatus and methods used in the USSR. Necessity of performing the determinations under conditions similar to those encountered in service.

9-114. Choix d'un outillage pour la coulée en coquille d'éprouvettes de traction de 13.8 mm de diametre pour la mesure des caractéristiques mécaniques des alliages légers coulés en coquille. (Selection of Equipment for Casting of Test Specimens 13.8 Mm. in Diameter for Determination of Mechanical Characteristics of Light-Alloy Castings.) Jean Duport. *Fonderie*, Jan. 1949, p. 1447-1454.

Use of standard equipment for casting test specimens used in determination of mechanical properties of cast light alloys. This is recommended because the method of casting and equipment influence these properties to a great extent.

9-115. Betrachtungen zum Verschleissproblem. (Observations on the Problem of Wear.) Werner Bottenberg. *Die Neue Giesserei*, v. 36, (new ser., v. 2), Feb. 1949, p. 39-45.

Methods of determining the wear of steel and iron. Present methods do not give comparable data; the various types of wear are so different that no generally valid indices can be expected. Because of the close correlation between wear and corrosion, successful methods of corrosion research are recommended for studying the problem of wear. Special wear-testing methods and results. 37 ref.

9-116. A History of Hardness Tests Based on Scratch Resistance Measurements. Ernest C. Bernhardt. *ASTM Bulletin*, Mar. 1949, p. 49-53.

A history of various scratch methods which have been devised as tests for hardness, compiled as a preliminary survey in a study of the scratch resistance of plastics. 14 ref.

9-117. Testing Vehicle Components With Strain Gages. Robert C. Hizer. *Product Engineering*, v. 20, Apr. 1949, p. 134-137.

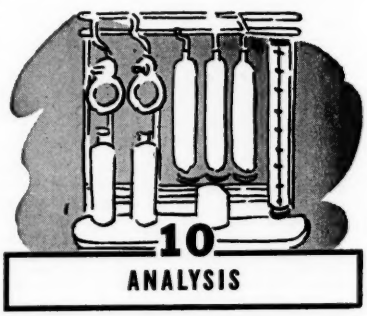
Stress measurements in service testing of heavy vehicles; construction and calibration of a drawbar; and measurement of drawbar pull and of torque in drive shafts, starter motors, and transmissions.

9-118. Gages Measure Strain on Rotating Engine Parts. *SAE Journal*, v. 57, Apr. 1949, p. 46-49. Based on "Strain Measurements on Rotating Parts" by R. E. Gorton and R. W. Pratt. (To be published in *SAE Quarterly Transactions.)*

For use on rotating parts, leads carry the electrical signal from the gage to a slip-ring assembly, which connects the rotating members with wires extending to the measuring or recording apparatus. The applications required extensive refinements of strain-gage apparatus and techniques.

For additional annotations indexed in other sections, see:

3B-62; 3D-29; 24A-52-55-57



10A—General

10A-54. The Direct Spectrochemical Analysis of Solutions Using Spark Excitation and the Porous Cup Electrode. Cyrus Feldman. *U. S. Atomic Energy Commission*, AECD-2392, Feb. 1, 1948, 10 pages.

Table gives approximate detection limits for various elements as compared with other continuous-feed methods.

10A-55. Sur les mangani- et nickélimolybdates. (Concerning the Manganese and the Nickel Molybdates.) R. Schaal and P. Souchay. *Analytica Chimica Acta*, v. 3, Jan. 1949, p. 1-14.

Properties and analytical applications, including determination of Mn, Mo, NH_4, Ag, and Ba. 12 ref.

10A-56. Analytische Auswertung von Reaktionen mit Geschmolzenem 8-Oxychinolin. (Analytical Applications of Reactions With Melted 8-Oxyquinoline.) F. Feigl and L. Baumfeld. *Analytica Chimica Acta*, v. 3, Jan. 1949, p. 15-20.

Metal compounds (hydroxides, oxides, and salts of inorganic and organic acids) react with fused hydroxyquinoline to form inner-complex oxinates. The fusion reactions make possible sensitive tests for Fe_2O_3 and V_2O_5 in the presence of greater quantities of other basic or acidic metal oxides.

10A-57. Die Jodometrische Bestimmung von Eisen und Kupfer. (The Iodometric Determination of Iron and Copper.) F. L. Hahn. *Analytica Chimica Acta*, v. 3, Jan. 1949, p. 65-68.

Modified procedure for which considerable economy of time and increased precision are claimed.

10A-58. Optical and Electrical Alterations to a Michigan Microphotometer. H. H. Grossman, E. W. Peterson, J. L. Saunderson, and V. J. Caldecourt. *Journal of the Optical Society of America*, v. 39, Mar. 1949, p. 261-263.

A microphotometer of the type described by Vincent and Sawyer was altered to eliminate certain objectionable features. It is being used principally for magnesium alloy analysis in the authors' laboratory.

10B—Ferrous

10B-24. Dosage du cuivre, du mercure et de l'arsénic en présence prédominante du fer. (Determination of Copper, of Mercury, and of Arsenic in the Presence of Predominant Amounts of Iron.) M. Jean. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 100-107.

Recommended methods. 14 ref.

10B-25. Unterscheidung unlegierter Stähle durch Funkenprufung. (Identifying Unalloyed Steels by the "Spark Test".) Walter Jäniche and Karl-Hugo Saul. *Stahl und Eisen,* v. 68, Aug. 12, 1948, p. 301-303.

How the spark test can be used to determine the approximate carbon contents.

10B-26. Determination of Iron and Undissolved Residue in Ores Without Use of Mercuric Chloride and Phosphoric Acid. (In Russian.) Yu. I. Usatenko and P. A. Bulakhova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1420-1421.

Proposes the use of phenylanthranilic acid having a much higher oxidation-reduction potential than trivalent iron, thus eliminating the necessity for phosphoric acid.

10B-27. Corrections During Determination of Carbon in Ferrochromium. (In Russian.) M. V. Babaev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1480-1486.

Critically investigates methods used in the USSR. Apparently, data obtained by different laboratories vary greatly. Proposes a method involving repeated calcination, which will decrease the possible error. Tabulated comparative data from typical determinations indicate advantages of this method.

10B-28. Determination of Columbium in Stainless Steel by Means of the "Steeloscope". (In Russian.) V. I. Blinov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1494-1495.

Use of the Cb line of wave length 5095.3, since the other spectral lines are too close to those of W and Ti lines for certain identification.

10B-29. A Method for the Rapid Photometric Determination of Tungsten in Steels. A. A. R. Wood. *Metallurgia,* v. 39, Mar. 1949, p. 266-268.

After dissolving the sample in a sulfuric-phosphoric acid mixture and fuming to convert the tungsten to a phosphotungstic acid, an aliquot is taken and to it are added sodium thiocyanate and stannous chloride in concentrated HCl. By taking blank readings, interference from most metals is avoided.

10B-30. A Geiger-Muller Counter Method of Determinnig Phosphorus in Steels. Ford R. Bryan and George A. Nahstoll. *ASTM Bulletin,* Mar. 1949, p. 55-61.

See abstract from *Journal of the Optical Society of America.* Item 10b-42, 1948.

10C—Nonferrous

10C-42. The Determination of Hydrogen; A New Universal Microgasometric Method. Leonard P. Pepkowitz and Everett R. Proud. *U. S. Atomic Energy Commission,* AECD-2365, Oct. 29, 1948, 10 pages.

Method applicable to the determination of total hydrogen in organic, inorganic, metal-organic compounds, and the low melting metals. Its basis is the evolution of the hydrogen in the sample within a sealed iron capsule and complete diffusion of the liberated hydrogen through the walls of the capsule into a simple vacuum system. The hydrogen is then determined by measuring the reduction in pressure which occurs in a static system when the hydrogen is converted into water over hot copper oxide.

10C-43. Applications analytiques de la phénothiazine. (Analytical Applications of Phenothiazine.) Raymonde Duval. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 21-26.

Spot tests that permit detection of silver on a drop plate or on paper. Use of the reagent for detection of Fe in presence of U; also Hg in the presence of Ag. By combined use of phenothiazine and diphenylcarbazide it is possible to detect 0.54 γ of Ag in the presence of 100 times its weight of mercury.

10C-44. L'acide p-diméthylaminobenzylidene-thiobarbiturique et ses dérivés dans la recherche des métaux nobles. (p-Dimethylaminobenzene Thiobarbituric Acid and Its Derivatives in the Study of Noble Metals.) T. Pavolini and F. Gambarin. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 27-33.

Proposed as sensitive reagents for the noble metals, especially Ag and Pd. 12 ref.

10C-45. Diphenylbenzidine as a Reagent for Vanadium. (In English.) J. Hoste. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 36-37.

Spot-test reaction for qualitative detection.

10C-46. Tetrabromophenolsulphonphthalein as Adsorption Indicator. I. Volumetric Estimation of Thallium. II. Volumetric Estimation of Silver and Thallium. (In English.) R. C. Mehrotra. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 73-82.

21 references.

10C-47. Nachweis und Gravimetrische Bestimmung von Thallium mit 8-Hydroxychinolin und 2,5-Dibrom-8-Hydroxychinolin. (Identification and Gravimetric Determination of Thallium With 8-Hydroxyquinoline and 2,5-Dibromo-8-Hydroxyquinoline.) F. Feigl and L. Baumfeld. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 83-88.

10C-48. Sur la séparation analytique des arséniates de zirconium en vue du dosage de l'arsénic. (Concerning the Analytical Separation of the Zirconium Arsenates in Connection With the Determination of Arsenic.) M. Jean. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 96-99.

This separation is not likely to be quantitative, since the zirconium arsenates do not possess a fixed composition.

10C-49. Extraction et dosage de traces de rhénium, en particulier dans les molybdénites. (Extraction and Determination of Traces of Rhenium, in Particular in the Molybdenites.) Suzanne Tribalat. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 113-125.

A simple technique applicable when the weight ratio rhenium-ore is as low as 10^{-7}.

10C-50. The Microdetermination of Gold With Hydroquinone and o-Dianisidine. (In English.) Giulio Milazzo. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 126-136.

Simple method in which Au is precipitated as Au_2S_3, using CuS or PbS as collector, and determined by a titrated solution of hydroquinone (with o-dianisidine as indicator) after eliminating the collector and dissolving in aqua regia. Theory of the titration reaction; possible interferences of some metals of the Pt group. 31 ref.

10C-51. The Determination of Manganese by the Peroxidisulphate Method. (In English.) Folke Nydahl. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 144-157.

The determination by the periodate method requires a rather long period of heating. Investigation of the faster peroxidisulfate method which has been considered rather unreliable. It was concluded that this method is at least as accurate as the periodate method, and is more rapid.

10C-52. Le dosage électrolytique du thallium. (Electrolytic Determination of Thallium.) Jean Besson. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 158-162.

Numerous methods compared. Cathodic deposition; use of a cathode made of Wood's metal or an amalgamated platinum cloth; anodic deposition; gravimetric determination by means of thioanilide is easier and more accurate.

10C-53. Spectrographic Analysis of High-Cobalt (Vitallium) Alloys. Y. T. Sihovonen, D. L. Fry, R. E. Nusbaum, and R. R. Baumgartner. *Journal of the Optical Society of America,* v. 39, Mar. 1949, p. 257-260.

A method used for control purposes in casting Vitallium is described. Improvements made in the course of the work. Reproducibility and accuracy data. Shows that a great deal of analytical work can be done with a spectrograph even though accurate comparison standards are not available.

10C-54. Polarography of the Various Oxidation States of Tungsten. James J. Lingane and Lyndon A. Small. *Journal of the American Chemical Society,* v. 71, Mar. 1949, p. 973-978.

An investigation of the above in hydrochloric acid, together with application of controlled potential electrolysis to the interpretation of polarograms and the preparation of lower oxidation states. 20 ref.

10C-55. Chemical Analysis of Tin-Containing Minerals of the Platinum Group. (In Russian.) P. V. Faleev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1422-1423.

A new method, based on introduction of H_2SO_4 during the dissociation of above minerals, thus avoiding loss of tin which takes place when using ordinary methods. Cementation of the platinoids by mercury greatly simplifies the analysis.

10C-56. Amperometric Titrations With Indicators. (In English.) Anders Ringbom and Borje Wilkman. *Acta Chemica Scandinavica,* v. 3, No. 1, 1949, p. 22-28.

New principle, the use of indicator substances, which makes it possible to determine certain metals not previously analyzed polarographically. The disturbing influence of many metals with low half-wave potentials is eliminated. Determinations of Al, Mg, and Ca.

10C-57. Organic Reagents for Platinum Metals. I. Determination of Palladium With 1,10-Phenanthroline. D. E. Ryan and P. Fainer. **II. The Gravimetric Determination of Rhodium.** R. L. Haines and D. E. Ryan. *Canadian Journal of Research,* v. 27, sec. B, Feb. 1949, p. 67-75.

10C-58. Separation of Cadmium From Large Quantities of Zinc. C. W. Barker, M. Cahill, and R. S. Young. *Metallurgia,* v. 39, Mar. 1949, p. 260.

Procedure applicable to solutions of high Zn content using Zn dust in warm dilute H_2SO_4. The method has been found to give faster results than the usual analytical method.

10C-59. Cobalt Estimation; Methods Available for Bright Nickel Solutions. H. D. Carter. *Metal Industry,* v. 74, Mar. 25, 1949, p. 226-228.

See abstract from *Journal of the Electrodepositors' Technical Society,* item 10A-37, 1949.

10C-60. (Book.) **Rationelle Metallanalyse.** (Rational Metal Analysis.) A. Cohen. 404 pages. 1948. Verlag Birkhäuser, Basel, Switzerland.

Selected chemical methods of analyzing the alloys of Al, Pb, Cu, Mg, Zn, and St. Principles of analyzing metals by chemical means, as well as basic operations, equipment, and materials. Quantitative data on adsorption, mixed precipitation, mixed distillation, and similar sources of error.

10D—Light Metals

10D-12. Determination of Beryllium in Silicate Rocks. (In English.) E. B. Sandell. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 89-95.

An improved method for traces which can be applied to sub-silicic as well as silicic types. Beryllium is separated, together with Al, from Ca, Mg, Mn, and Fe, by ammonia precipitation in the presence of mercaptoacetic acid. The Be in the precipitate is brought into solution, and separated from Ti and small amounts of Fe, and possibly other coprecipitated metals, by double fusion with NaOH. The final determination is made fluorimetrically.

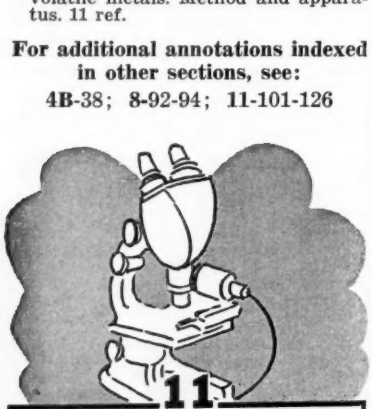
10D-13. The Determination of Aluminium by the Ammonium Benzoate Method. An Investigation Into Factors Affecting the Separation and Estimation of Aluminium and Beryllium. (In English.) G. H. Osborn and A. Jewsbury. *Analytica Chimica Acta,* v. 3, Jan. 1949, p. 108-112.

10D-14. Magnesiumbestimmung in Aluminiumlegierungen mittelst Hochvakuum. (A High-Vacuum Method for Determining Magnesium in Aluminum Alloys.) P. Urech, P. Muller, and R. Sulzberger. *Helvetica Chimica Acta,* v. 32, Mar. 15, 1949, p. 371-377.

The proposed new industrial-control method is based on the principle of high-vacuum distillation. Its range of accuracy is 0.01-0.02%, provided the alloy contains no other volatile metals. Method and apparatus. 11 ref.

For additional annotations indexed in other sections, see:

4B-38; 8-92-94; 11-101-126



11 APPARATUS, INSTRUMENTS and METHODS

11-100. The Preparation of Thin Steel Specimens by Cutting; and the Isolation of Non-Metallic Inclusions *in Situ* by a Simplified Chemical Method. Carl Benedicks and Olof Tenow. *Journal of the Iron and Steel Institute,* v. 161, Mar. 1949, p. 177-186.

A method of preparing, by means of a microtome, thin steel specimens down to 20μ in thickness; development of the method. These specimens were used for the isolation of nonmetallic inclusions in steel and have shown the abundant occurrence, in AlN-rich steel, of thin, adsorbed films. 27 ref.

11-101. Nucleonics and Analytical Chemistry Symposium. *Analytical Chemistry,* v. 21, Mar. 15, 1949, p. 318-368.

Consists of following papers: "Radioactive Isotopes as Tracers," Peter E. Yankwich; "Radiochemical Activity Analysis," David N. Hume; "Determination of Naturally Occurring Radioactive Elements," Clement J. Rodden· "Method of Activation Analysis," G. E. Boyd; "Instruments for Measuring Radioactivity," C. J. Borkowski; "Measurement Techniques of Applied Radiochemistry," Truman P. Kohman; "Industrial Applications of Radionuclides," John W. Irvine, Jr. 347 ref.

11-102. Modified Silica Replica Technique. J. J. Comer and F. A. Hamm. *Analytical Chemistry,* v. 21, Mar. 15, 1949, p. 418-419.

Improved replica technique for electron microscopy.

11-103. An Electrical Pressure Meter for the Measurement of Open-Hearth-Furnace Differential Pressures. S. S. Carlisle and B. O. Smith. *Journal of the Iron and Steel Institute,* v. 161, Mar. 1949, p. 222-229.

A sensitive meter developed by the British Iron and Steel Research Association. It can be installed close to the measuring point on the roof of the furnace; thus, errors due to long pressure pipes are eliminated. It is specifically designed for remote indication.

11-104. Information Obtained From the Interaction of Slow Neutrons With Matter. James Rainwater. *Transactions of the New York Academy of Sciences,* ser. 2, v. 11, Jan. 1949, p. 72-80.

The slow neutron has been found to be an excellent tool for study of the atomic and nuclear properties of matter. Some of the information which can be obtained from such studies.

11-105. Determination of Absolute Intensities of X-Ray Reflexions From Relative Intensity Data. S. H. Yu. *Nature,* v. 163, Mar. 5, 1949, p. 375-376.

In 1942 the author proposed a simple method for determination of absolute from relative intensities, which has since been made rigorous. Details of practical application.

11-106. A Correction to the Diameter Measurement of Diffuse X-Ray Diffraction Rings. L. G. Finch. *Nature,* v. 163, Mar. 12, 1949, p. 402-403.

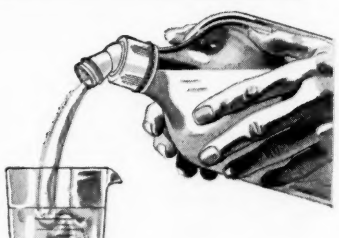
Lattice parameter measurements of cold worked metals are subject to appreciable error if no provision is made for the lack of coincidence between the $K_{\alpha 1}$ peak and the apparent peak, as measured, of the broadened doublet. Describes correction method.

11-107. A Unit-Magnification Optical System With Long Working Distance for Microscopical Applications. J. Dyson. *Nature,* v. 163, Mar. 12, 1949, p. 400.

Applicable to microscopy of hot metallurgical specimens inside a vacuum furnace, examination of electrode conditions inside a vacuum tube, and examination of nuclear plates which may involve working through considerable thicknesses of glass and emulsion.

11-108. Subtraction of Atom Images

DRIPLESS
POURING SPOUT
stops dripping of acids, reagents, and other liquids



This new dripless pouring spout, by eliminating dripping of acids, will help prevent personal injury by acid burns and protect laboratory apparatus and furniture. Two types of dripless spouts are available, one having 38 mm. threaded skirts to fit the J. T. Baker acid bottle, and another to fit the Baker & Adamson, Du Pont, Mallinckrodt, and Merck acid bottles. In addition, a group of dripless spouts are available for reagents and other laboratory liquids for use on bottles having 22, 24, and 28 mm. threaded skirts. All spouts, including air-tight caps, are made of polyetheylene plastic, will resist acid, and are easily cleaned.

There is a tapering groove leading from the top of the orifice to the "auxiliary volume recess control," which is set back a short distance from the lip of the pour-out spout. When pouring ceases, a small amount of fluid is pocketed in the recess control. Simultaneously with this action, there is a rush of liquid forward of the control and on the side wall of the orifice to the tapered groove which widens out at the merging of same into the recess. This action unites the liquid in the tapered groove and the control recess which tends to move slowly back towards the inside of the vessel as the vessel is brought to an upright position. This action causes the liquid forward of the tip of the orifice to either sever itself from the main body or be brought back into the vessel.

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From a Fourier Synthesis of a Crystal Lattice. (In English.) Chr. Finbak and N. Norman. *Acta Chemica Scandinavica,* v. 2, No. 9, 1948, p. 813-827.

How the images of the different atoms may be removed from the density function determined by two-dimensional Fourier synthesis of a crystal lattice. 16 ref.

11-109. Tastgerät fur Drahtziehsteine. (A Micro-Instrument for Testing Wire-Drawing Dies.) Hans Mucke. *Stahl und Eisen,* v. 68, Dec. 2, 1948, p. 484.

An instrument for examining the diameters and shapes of wire-drawing dies.

11-110. Rontgenmikroskopische Untersuchung an Leicht-metall-Legierungen. (Microradiographic Investigation of Light-Metal Alloys.) Eugen Osswald. *Zeitschrift fur Metallkunde,* v. 40, Jan. 1949, p. 12-15.

Compared with ordinary microscopic methods. The geometric form of the matrix crystal and its inclusions give information about the formation of the phases of metallic systems.

11-111. Rontgenaufnahmen an Blechen dunner Wandstärke. (X-Ray Investigation of Thin Sheet Metals.) Rudolf Lindemann. *Zeitschrift fur Metallkunde,* v. 40, Jan. 1949, p. 36-40.

Experiments to establish optimum voltages for the above. 10 ref.

11-112. Metallographic Technique for Steel; Polishing. *Metal Progress,* v. 55, Mar. 1949, p. 344B.

Typical micrographs illustrative of under-water and dry cutting; prevention of seepage in clamp mounts; preservation of inclusions; disturbed metal and its elimination; and steps in polishing—lead lap method.

11-113. A Study of Metallic Electrodes Prepared by Sublimation. B. C. Bradshaw. *Journal of Chemical Physics,* v. 17, Mar. 1949, p. 344.

Pure zinc metal was vacuum-sublimed on platinum wire set in the end of glass tubes. The electrodes, thus prepared, were placed in a dilute solution of pure $ZnCl_2$ saturated with basic zinc carbonate, air being rigidly excluded. Results so far obtained indicate that electrodes prepared in this way are free from strain and are reversible. It is hoped that this may be a general property of crystals formed in this way.

11-114. Infra-Red Absorption Analysis. 8. Principles, Application, and Technique. R. Quarendon. *Paint Manufacture,* v. 19, Mar. 1949, p. 92-94.

Bolometers, photo-elements, pneumatic cells, merits of infrared detectors, amplifiers and recorders, and the cathode-ray screen.

11-115. Application of the High Temperature Calorimeter to the Determination of the Heats of Formation of Na-Sn and Li-Sn Alloys. George R. Barber, Leo Brewer, LeRoy A. Bromley, Raleigh L. McKisson. *U. S. Atomic Energy Commission,* AECD-2294, July 1948, 36 pages.

Method devised for using the high-frequency induction coil as a high-temperature calorimeter. 24 ref.

11-116. Uber eine neue Einrichtung am Universal-Elektronenmikroskop zur fast vollständigen Vermeidung der thermischen Objekbelastung. (A New Device for the Universal Electron Microscope Which Will Almost Completely Protect the Sample From Heating.) Manfred von Ardenne. *Kolloid Zeitschrift,* v. 111, Oct. 1948, p. 22-30.

This device is a combination of a microscreen and hydrogen cooling. It will reduce the temperature at the object to such an extent that the electron density at the object can be multiplied six times before the same temperature is attained. Electron micrographs illustrate typical results.

11-117. Metalografia das ligas de aluminio-aluminio-niquel. (Metallography of Aluminum and Aluminum-Nickel Alloys.) Eros Orosco. *Boletim da Associacao Brasileira de Metais,* v. 4, Oct. 1948, p. 413-434; discussion, p. 435.

Reproduction of a series of colored photomicrographs of specimens prepared by use of a special method. Composition of etching agents, optimum conditions of the process, and influence of different factors, such as time of etching, concentration of etching agents, etc. 22 ref.

11-118. Aluminum Oxide Films as Supports for Samples Being Studied by Means of the Electron Microscope. (In Russian.) S. L. Pupko. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Nov. 21, 1948, p. 259-260.

Method of production. Optimum conditions for separation of film from the base metal.

11-119. Investigation of Structural-Mechanical Properties of Metallic Dispersed Systems by Use of a Conical Plastometer. (In Russian.) B. Ya. Yampol'skii and N. A. Rebinder. *Kolloidnyi Zhurnal* (Colloid Journal), v. 10, Nov.-Dec. 1948, p. 466-474.

Special adaptation of the conical plastometer, in which the course of immersion of the cone is recorded automatically. Limited (minimum) stresses were determined for metallic Na and for amalgams of lead, with Pb contents of 32-90%, at various temperatures.

11-120. Determination of Electrical Conductivity of Metals and Alloys in a Rotating Magnetic Field. (In Rus-

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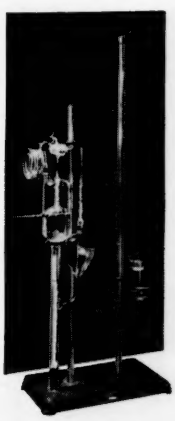

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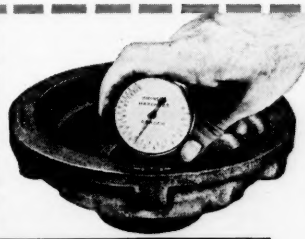

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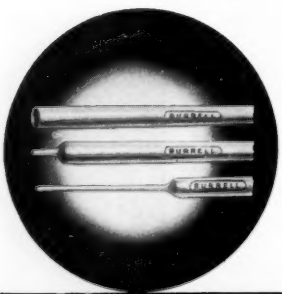

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sian.) A. R. Regel. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Dec. 1948, p. 1511-1520.

New method for alloys and intermetallic compounds over a wide range of temperature, particularly in the region of the solid-liquid transition. Theoretical bases of the method. Practical application, including a description of the apparatus used. Typical determinations on indium. 15 ref.

11-121. Metallographic Investigation of Hard Alloys of the Metalloceramic Type (Carbides). (In Russian.) N. M. Zarubin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1434-1436.

Proposes the use of a series of reagents particularly applicable to individual components. Optimum conditions of determination.

11-122. Electrolytic Polishing of Metallographic Specimens. (In Russian.) A. I. Gershevich, T. A. Mikhailova, and D. O. Slavin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1437-1438.

A new composition of phosphoric-sulfuric acid electrolyte with the addition of chromium anhydride, glycerin, and water, which is particularly efficient for the polishing of high-Cr cast iron, stainless steel, and alloy steel using low voltages. Optimum conditions.

11-123. Application of the Method of Determination of Electrical Resistance in Investigation of Austenitic Alloys. (In Russian.) G. V. Estulin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1439-1444.

The relationship of electrical resistance of Cr-Ni steels, of the types 14-14, 18-8, 20-25, 15-60, to grain sizes. The method of investigation of the crystal structure of the above steels is based on this phenomenon.

11-124. Metallography of Aluminum Alloys. F. Keller. *American Society for Metals,* "Physical Metallurgy of Aluminum Alloys," 1949, p. 93-128.

Procedures which have been used successfully for many years for the various aluminum alloys. Numerous photomicrographs show typical structures.

11-125. Signification de la dimension cristalline mesurée d'apres la largeur de raie Debye-Scherrer. (Significance of Crystal Dimensions Measured by Use of the Widths of Debye-Scherrer Bands.) Félix Bertaut. *Comptes Rendus,* v. 228, Jan. 10, 1949, p. 187-189.

Critically analyzes Laue's formula for determination of apparent linear dimensions. Proposes use of a term which indicates the difference of the apparent dimension from that of the true mean dimension.

11-126. Essais des matériaux dans l'industrie métallurgique; Die Materialprufung in der Metallindustrie. (The Examination of Materials in the Metal Industry.) A. Meyer. *Pro-Metal,* v. 2, Feb. 1949, p. 316-327.

Colorimetric and metallographic methods. Apparatus and procedures. Structures of different alloys. (To be continued.)

11-127. Fuel Control in the Open-Hearth Plant. F. A. Gray. *Journal of the Institute of Fuel,* v. 22, Feb. 1949, p. 157-165.

Details of methods and equipment used by a British steel plant having both acid and basic furnaces. Besides temperatures, the control and measurement of air fuel ratio, furnace pressures, and gas flows are dealt with.

11-128. Crystal Setting by X-Rays. (In English.) J. W. Jeffery. *Acta Crystallographica,* v. 2, Mar. 1949, p. 15-21.

See abstract from *Journal of Scientific Instruments and of Physics in Industry,* item 11-73, 1949.

11-129. Crystal Symmetry and Physical Properties: Application of Group Theory. (In English.) S. Bhagavantam and D. Suryanarayana. *Acta Crystallographica,* v. 2, Mar. 1949, p. 21-26.

Group-theoretical methods for studying the effect of symmetry on all possible physical properties (known and already measured or not known) which depend on crystal symmetry. Tables show the character of the transformation matrices for each possible combination of the above quantities, the number of independent constants needed to describe the corresponding phenomenon in each of the 32 classes, and actual examples of physical properties corresponding to the different possible combinations. 15 ref.

11-130. Note on the Bhagavantam-Suryanarayana Method of Enumerating the Physical Constants of Crystals. (In English.) H. A. Jahn. *Acta Crystallographica,* v. 2, Mar. 1949, p. 30-33.

A method alternative to that of Bhagavantam and Suryanarayana (see above abstract) for enumerating, by group theory, the number of independent constants for any physical property of crystals in the 32 classes. The method consists of finding first the explicit form of the representation in question for the full group of all rotations and reflections and then obtaining the form for the individual crystal classes by specialization.

11-131. The Measurement and Correction of Intensities From Single-Crystal X-Ray Photographs. (In English.) G. Kaan and W. F. Cole. *Acta Crystallographica,* v. 2, Mar. 1949, p. 38-43.

Effect of spot size in single-crystal X-ray photographs on errors in intensity measurements made by eye estimation and by direct photometry of the negative. Shows how the latter has been used to obtain intensities from equi-inclination Weissenberg photographs within an accuracy of ±10%.

11-132. New Techniques Applied to the Buerger Precession Camera for X-Ray Diffraction Studies. Howard T. Evans, Jr., S. G. Tilden, and Douglas P. Adams. *Review of Scientific Instruments,* v. 20, Mar. 1949, p. 155-159.

Usefulness of the method for single-crystal X-ray diffraction studies is increased by several techniques.

11-133. Absorption Corrections in X-Ray Studies of Preferred Orientation. R. Smoluchowski and R. W. Turner. *Review of Scientific Instruments,* v. 20, Mar. 1949, p. 173-174.

A general formula is derived for evaluation of correction factors in flat specimens. In practical applications a graphical presentation proves to be particularly useful.

11-134. The Proton Microscope. Claude Magnan. *Nucleonics,* v. 4, Apr. 1949, p. 52-66.

Apparatus making possible magnifications of 600,000 or more, which has just been built at College de France, Paris. The electron microscope magnification limit is stated to be 100,000×. 24 ref.

11-135. Electronic Computer Applications. Part II. David Fidelman. *Radio-Electronic Engineering,* v. 12 (bound with *Radio & Television News,* v. 41), Apr. 1949, p. 6-9.

Use of electronic computers in various automatic process-control applications. Production methods for control of heat treatment process and for register in 3-color printing.

11-136. The Francis Thickness Tester: Application to the Measurement of Electrolytic and Hot-Dipped Tinplate Coatings. K. W. Caulfield and W. E.

Hoare. *Sheet Metal Industries,* v. 26, Apr. 1949, p. 753-756, 762.

Slight modifications in the instrument first described by Howard T. Francis in 1948.

11-137. (Book) Multiple-Beam Interferometry of Surfaces and Films. S. Tolansky. 187 pages. 1948. Oxford University Press, Amen House, London, E.C.4, England.

Technique and achievements of the application of multiple-beam interference of light to the study of surface topography of solids and to the examination of properties of thin films. Applications in chemistry, crystallography, crystal physics, and metallurgy. 30 ref.

11-138. (Book) Transactions, Instruments and Measurements Conference (Stockholm, 1947). 252 pages. 1948. Norrköpings Tidninggars Aktiebolag, Norköping, Sweden.

Forty-one papers under the main headings of: Industrial Spectroscopy; Testing of Materials and Mechanical Measurements; Industrial Control; Metrology; and General and Miscellaneous Subjects. Most of the articles are in English, but a few are in French, German, or Swedish. The more important individual papers are being abstracted separately.

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12 INSPECTION and STANDARDIZATION

12-58. Continuous Gaging Determines Average Stock Thickness. A. C. Sanford. *American Machinist,* v. 93, Mar. 24, 1949, p. 100-103.

By overlooking local bumps and surface depressions in moving sheet stock, continuous gages indicate average thickness and trends in dimensional changes.

12-59. X-Ray Examination of Materials and Application to Shipyard Welding. T. J. Heal. *Research,* v. 2, Mar. 1949, p. 119-126.

Fundamental principles of radiography, and above applications.

12-60. The Statistical Analysis of Experimental Data. B. Saravanos. *Aircraft Engineering,* v. 21, Mar. 1949, p. 64-70, 75.

New approach employing a graphical method for investigating non-normal frequency distributions.

12-61. Economic Aspects of Standardization. F. E. Powell. *Standards World,* v. 1, Spring 1949, p. 59-76.

A general discussion of advantages.

12-62. Cartridge Case Inspection by Reflectogage. Fred M. Arnold. *Metal Progress,* v. 55, Mar. 1949, p. 320-323.

Use of the Reflectogage—an inspection instrument based on use of high-frequency sound waves, to detect defects in brass cartridge cases. The defect consisted of internal ruptures in the head parallel to the base.

12-63. Diversified Techniques Involved in Multipurpose Quality Control. O. W. Hitchcock. *Steel,* v. 124, Apr. 4, 1949, p. 98-101, 128.

Statistical and other methods used to control manufacture of high-precision aircraft parts. Said to be applicable to almost any metal product made under ordinary or unusually severe specifications.

12-64. How to Avoid Rejects on Large Interchangeable Parts. N. N. Sawin. *American Machinist,* v. 93, Apr. 7, 1949, p. 98-100.

Recommendations as to working dimensions, measuring techniques, and clamping methods.

12-65. Comparator Accessories Speed Inspection. Herbert Chase. *American Machinist,* v. 93, Apr. 7, 1949, p. 110-111.

With an adjustable fixture base applied to the tables of bench-type Jones & Lamson comparators it is possible to position the fixture exactly where desired in relation to the lens system of the comparator.

12-66. Quality Control in Tin Plate Production. Harry C. Morrow. *Instrumentation,* v. 3, 1st qtr. 1949, p. 8-11.

Methods and equipment, including annealing; hot-dip and electrolytic plating; preliminary surface treatment; inspection; and shearing. Control systems are diagrammed.

12-67. Electronic Gauges. (Concluded.) Jean Schwartz. *Microtecnic* (English Edition), v. 3, Jan.-Feb. 1949, p. 10-18. Translated from the French.

Some complete systems. 44 ref.

12-68. Workpiece Inspection in Modern Mass Production. H. Kieffer. *Microtecnic* (English Edition), v. 3, Jan.-Feb. 1949, p. 38-41. Translated from the French.

Organization, procedures, and equipment of inspection departments for checking quality of metal equipment and parts.

12-69. The Standardization and Simplification of Steel Products. L. H. Winkler and J. G. Morrow. *ASTM Bulletin,* Mar. 1949, p. 20-22. A condensation.

While the scope of the discussion is specifically steel products, many of the comments and much of the information is applicable to other materials.

12-70. The Consumer Looks at Steel Specifications. Part I. Muir L. Frey. *Steel Processing,* v. 35, Mar. 1949, p. 137-142. A condensation.

Development of SAE and AISI specifications, discussing the many solved and unsolved problems involved. Believes that the number of standard grades is still excessive. (To be continued.)

12-71. Measurement of Close Tolerance Parts. *Materials & Methods,* v. 29, Apr. 1949, p. 79, 81.

Thermal-expansion corrections to be used when measuring parts made from plain carbon and low alloy steels, Al and Al alloys, brass, and bronze.

12-72. Turbine-Blade Checking. *Aircraft Production,* v. 11, Apr. 1949, p. 115.

Optical instrument especially suitable for work necessitating frequent changes in blade profiles.

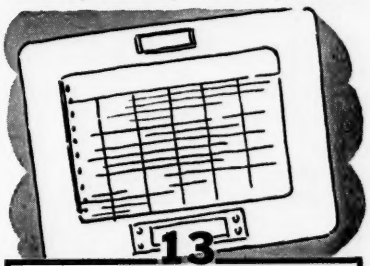
12-73. Simplifying Quality Control. F. H. Wells. *Electrical Manufacturing,* v. 43, Apr. 1949, p. 112-113, 198, 200.

How probability paper can be used for design development and routine testing both to measure quality level and draw attention to variations in quality that need correction.

12-74. Steel Specifications . . . As Seen by Producers . . . As Seen by Consumers. *SAE Journal,* v. 57, Apr. 1949, p. 36-39. Based on two papers: "Steel Compositions and Specifications From the Steel Producer's Viewpoint," Charles M. Parker; and "The Consumer Looks at Steel Specifications," Muir L. Frey.

Advantages and disadvantages of existing methods from the two viewpoints. Recommendations.

For additional annotations indexed in other sections, see:
14D-19; 19B-50; 20A-137; 22D-27



13 TEMPERATURE MEASUREMENT and CONTROL

13-24. What's Inside Temperature Controls? Part 1. David Fidelman. *American Machinist,* v. 93, Mar. 24, 1949, p. 94-97.

Systems for temperature measurement. Why electronic controllers help small as well as large shops.

13-25. Tungsten-Molybdenum Thermocouples. R. D. Potter and N. J. Grant. *Iron Age,* v. 163, Mar. 31, 1949, p. 65-69.

Use in the study of high-temperature alloys has resulted in improvement of the range of satisfactory service up to 3990° F. Metallurgical factors to be observed in order to attain optimum results. Procedure for calibrating the thermocouple. Influence of contamination on standard calibration curves.

13-26. The Fundamentals of Pyrometry. III (Concluded.) W. H. Steinkamp. *Industrial Heating,* v. 16, Mar. 1949, p. 432, 434, 436, 438, 440, 442.

Radiation pyrometers; the Radiamatic tube; the radiant-energy theory; optical pyrometry, and the Optimatic system. Emissivity table for common materials.

13-27. Low Temperature Radiation Pyrometry in Industry. J. C. Mouzon and C. A. Dyer. *Journal of the Optical Society of America,* v. 39, Mar. 1949, p. 203-210.

Problems encountered, with particular emphasis on the measurement of low surface temperatures 100-400° F.). A low-range radiation pyrometer for use on such applications.

13-28. What's Inside Temperature Controls? Part 2. David Fidelman. *American Machinist,* v. 93, Apr. 7, 1949, p. 112-115.

Circuit diagrams and explanations of four basic types of timing for heat treating processes, as found in commercial devices.

13-29. A Method of Controlling Rate-of-Change of Temperature. P. H. Bigg and F. D. Jones. *Journal of Scientific Instruments and of Physics in Industry,* v. 26, Mar. 1949, p. 109-111.

Rate of change of temperature may be controlled automatically by transforming it into a temperature difference, by use of differing thermal-time constants, and using this

temperature difference to control heat input or extraction. A particular application. Adaptation to precise control.

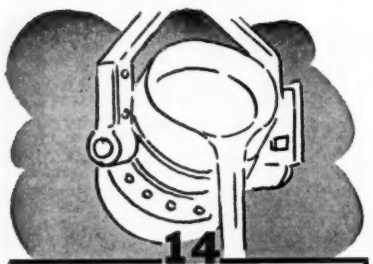
13-30. "Heat Inertia" in Problems of Automatic Control of Temperature. Part II. Victor Broida. *Instruments*, v. 22, Mar. 1949, p. 222-224, 254, 256, 258, 260, 262, 264.

Some problems related to continuous automatic control systems. Three of the simpler types of automatic controllers. Consists largely of mathematical derivations. (To be continued.)

13-31. Apparatus for Automatic Uniform Controlled Rise of Temperature. V. C. Taxwood and C. R. Stock. *ASTM Bulletin*, Mar. 1949, p. 76-77.

Apparatus successfully used in plastics testing. However, it is believed applicable to many other purposes, for example, control of electrical annealing furnaces.

For additional annotations indexed in other sections, see:
9-108; 11-127



FOUNDRY PRACTICE

14A—General

14A-39. Investment Casting on a Shoestring. K. W. Thompson. *American Machinist*, v. 93, Mar. 24, 1949, p. 104-105.

How the four essential units of equipment—wax injector, centrifuge, furnace and oven—were made for less than $1000. Also how to use them.

14A-40. Foundry Techniques Are Challenge to Patternmaker. Frank C. Cech. *Foundry*, v. 77, Apr. 1949, p. 78-81, 226.

A series of patterns submitted in a contest.

14A-41. Effect of Cellulose Materials on Foundry Sands. Tom Barlow and C. P. Loucks. *Foundry*, v. 77, Apr. 1949, p. 82-84, 243-245.

Experimental data obtained during studies at Battelle Memorial Institute and Harry W. Dietert Co.

14A-42. Casting Matchplates in Plaster. David C. McConnell. *Canadian Metals and Metallurgical Industries*, v. 12, Mar. 1949, p. 18-19, 36.

Process for producing "multiple-pattern" match plates from one master pattern, using the plaster molding process.

14A-43. Cores, Core-Making and Core-Making Materials. J. G. Gilbert. *Foundry Trade Journal*, v. 86, Feb. 17, 1949, p. 133-137; Feb. 24, 1949, p. 155-158.

For a foundry which makes miscellaneous castings.

14A-44. Powdered Graphite in Foundry Practice. P. Nicolas. *Foundry Trade Journal*, v. 86, Feb. 24, 1949, p. 160-161. Translated from *Fonderie*.

Results of X-ray examination of the structure of graphites from Brazil, Italy, Madagascar, and Morocco. Recommendations concerning the best graphite for different foundry applications, on the basis of structure observed.

14A-45. The Mechanics of Moulding-Sand Properties. Archibald Jamieson. *Foundry Trade Journal*, v. 86, Mar. 3, 1949, p. 183-184.

Limitations of orthodox sand testing, which does not tell to what extent the sand is moldable. The nature of sand movement during ramming and distortion during compression testing. Relationship of "flowability" determined by different methods to molding operations. A unit of ramming work to cause distortion of a definite amount in a given volume of weight or sand is proposed. Use to compare moldabilities is believed feasible.

14A-46. Application of Hydraulic Calculations to the Design of Pouring Gates for Castings. J. Kieswetter. *Engineers' Digest*, v. 10, Feb. 1949, p. 47-50. Translated and condensed from *Hutnické Listy* (Metallurgical Topics), v. 3, June 1948, p. 165-170.

Previously abstracted from original. See item 14a-142, 1948.

14A-47. Synthetic Resin Core Binders. G. L. Harbach. *Foundry Trade Journal*, v. 86, Mar. 10, 1949, p. 203-208; Mar. 17, 1949, p. 225-229; discussion, p. 229-233.

An investigation of the properties of synthetic resins as core binders.

14A-48. Worker Effort Reduced by Foundry Mechanization. Eugene C. Zack. *Production Engineering & Management*, v. 23, Apr. 1949, p. 65-66.

14A-49. (Book) **Modern Metal Production.** J. W. Day, editor. 122 pages. 1947. Distributed by New World Publications, P.O. Box 1221, Los Angeles 53, Calif. (Compiled in Europe and printed in England.)

Historical, commercial and technical aspects of continuous casting. Notes on centrifugal casting, powder metallurgy, impact extrusion. immersion casting, and the pre-refining of molten substances. 23 ref.

14B—Ferrous

14B-40. "Electrocasting" Steel. *Western Machinery and Steel World*, v. 40, Mar. 1949, p. 98-101.

Procedures and equipment in manufacture of miscellaneous steel castings, using a 3000-lb. electric furnace.

14B-41. High-Strength Cast Irons. Tracy C. Jarrett. *Foundry*, v. 77, Apr. 1949, p. 66-73, 228, 230.

Mode of occurrence and distribution of excess carbon in cast iron, and ways in which it may be modified. The different structures obtainable with different treatments and different alloy additions. Discussion of heat treatment. Development of centrifugal casting method for piston rings.

14B-42. Describes Development of Ductile Cast Iron. *Foundry*, v. 77, Apr. 1949, p. 111, 114, 116.

Summarizes recent talks by Don J. Reese and Albert P. Gagnebin on new material developed by International Nickel Co. Potential applications.

14B-43. Casting Large Wheels and Drums. Pat Dwyer. *Foundry*, v. 77, Apr. 1949, p. 172-173, 175, 178-179.

Procedure for large wheels having gray-iron rims and hubs and wrought-iron spokes.

14B-44. Areias de fundicao para aco. (Molding Sand for Steel.) Carlos Dias Brosch and Rodolfo Mottin. *Boletim da Associacao Brasileira de Metais*, v. 4, Oct. 1948, p. 451-462; discussion, p. 463-464.

Addition of an oxidation agent (MnO_2) eliminates the possibility of impregnating the inside mold surface by the flux, thus resulting in much higher quality of steel castings.

14B-45. Prevention of Hot Tears in Thick-Walled Centrifugally Cast Steel Tubes. J. F. Wallace and J. L. Martin. *American Foundrymen's Society*, Preprint No. 3, 1949, 6 pages.

Mechanism of formation and means of prevention of hot tears in centrifugally cast tubes. Mathematical expressions for variables involved.

14B-46. A Study of Insulating and Mildly Exothermic Antipiping Compounds Used for Steel Castings. S. L. Gertsman. *American Foundrymen's Society*, Preprint No. 19, 1949, 9 pages.

A standard casting was designed and a series of tests made. Information was obtained on thermal characteristics produced in the riser metal, the minimum size of riser that can be used for the standard casting with each compound, the type of shrinkage cavity produced in the riser, and the length of time required for the top of the head to freeze. Method can be used as a standard to evaluate the efficiency of new compounds.

14B-47. Beitrag zur Auswahl und Verwendung von Form und Kernschwärzen fur NE-Guss. (Selection and Use of Mold and Core Blacks for NE Castings.) Edmund R. Thews. *Die Neue Giesserei*, v. 36, (new ser., v. 2), Feb. 1949, p. 47-49.

A study of different carbon blacks and their effect on the gas permeability of sand molds and on the general qualities of castings. Compares the gas permeability of sand molds with and without carbon blacks.

14B-48. Blackheart Malleable Cast Iron; Its Production and Properties. *Metallurgia*, v. 39, Mar. 1949, p. 247-252.

Methods and equipment of a British plant. Properties and applications.

14B-49. A Decade of Progress in British Ironfounding. W. W. Braidwood. *Foundry Trade Journal*, v. 86, Mar. 24, 1949, p. 253-260; Mar. 31, 1949, p. 283-288.

New developments in equipment and procedures. 40 ref.

14B-50. Control of Cupola Stack Emissions. John F. Drake, Theodore G. Kennard, and W. A. Saylor. *Iron Age*, v. 163, Apr. 7, 1949, p. 88-92.

A closed charging bell, dry-dust collector, and wet washer, which results in stack emissions within the limits set by the Los Angeles County air-pollution-control authorities. Nature of the material collected.

14C—Nonferrous

14C-28. Bushings and Bearings From San Francisco. *Western Machinery and Steel World*, v. 40, Mar. 1949, p. 78-81.

Production of bronze bushings and bearings. The plant is fully integrated from melting furnaces to warehouses. Melting, mold making, core making, casting, machining, and storage are all provided.

14C-29. Cast Bronze Bushings. Leighton M. Long. *American Society for Metals*, "Sleeve Bearing Materials," 1949, p. 131-135; discussion, p. 136-137; 146-147.

Effects of variations in casting and machining procedure on properties.

14C-30. Metal Melting and Its Relation to Gases in Metal. O. Edwin Decker. *American Foundrymen's Society*, Preprint No. 10, 1949, 3 pages.

Suggestions for melting brasses and bronzes to produce sound cast-

ings. Proper melting furnace design, size of crucible in relation to furnace, proper control and furnace maintenance.

14C-31. Recent Developments in Theory and Practice of Insulating Sleeves, Pads, and Risers for Non-Ferrous Casting. Kurt A. Miericke. *American Foundrymen's Society,* Preprint No. 17, 1949, 4 pages.

14C-32. Gas-Fired Melting of Copper-Base Alloys in a Reducing Atmosphere. Donald C. Caudron. *American Foundrymen's Society,* Preprint No. 53, 1949, 3 pages.

Advantages.

14C-33. Naadloos gietwerk. (Seamless Castings.) B. Vlasblom. *Metalen,* v. 3, Feb. 1949, p. 130-134.

A method of seamless casting applicable to metals with low melting points. Comparison with other methods from the viewpoints of cost and quality of castings. Advantages.

14C-34. Nichteisenmetall-Schleuderguss und Schleuderverbundguss. (Nonferrous Centrifugal Casting and Centrifugal "Bonded" Casting.) Gunther Schwietzke. *Die Neue Giesserei,* v. 36 (new ser., v. 2), Feb. 1949, p. 35-39.

An illustrated study of different centrifugal-casting processes. Their various uses and properties.

14C-35. Bronze Rod. W. T. Pell-Walpole and V. Kondic. *Metal Industry,* v. 74, Mar. 18, 1949, p. 203-206.

Production of small lengths of high-quality rod in a simple semi-continuous machine. Most of the desirable features of continuously cast bronze can be obtained with this inexpensive plant by any foundry normally producing chill cast bronzes by static casting methods. 11 ref.

14C-36. Production of Thin-Walled Die Castings. H. K. Barton. *Machinery* (London), v. 74, Mar. 31, 1949, p. 415-418.

Advantages of thinner walls. Use of composite cores; prevention of distortion during ejection; and elimination of ejector marks.

14C-37. (Book) **Non-Ferrous Castings.** R. F. Hudson. Chapman & Hall, 37 Essex Street, London, W.C.2, England. 22s. net.

Stated purpose is to "bring the scientific viewpoint to the practical man." Raw materials used in the nonferrous foundry; nonferrous molding sands, and the effect of various constituents and additions; effect of additions to sand, and thermal conductivity of sands and special molding mixtures; sand testing, core sands and core binders (no information is given regarding phenol formaldehyde or urea formaldehyde). Melting and molding practice including types of furnaces, crucibles, and their maintenance, and the correct melting technique for tin bronzes, high-tensile bronzes, nickel bronze, and other special alloys.

14D—Light Metals

14D-19. Aluminum Castings. S. A. J. Sage. *Metallurgia,* v. 39, Feb. 1949, p. 202-205.

Some aspects of molding, casting, inspection, and testing which contribute to the production of high-quality and complex castings.

An informal, easy-to-read book, part history, part criticism

TALKS ABOUT STEELMAKING

By Harry Brearley

236 pages—$4.00

American Society for Metals

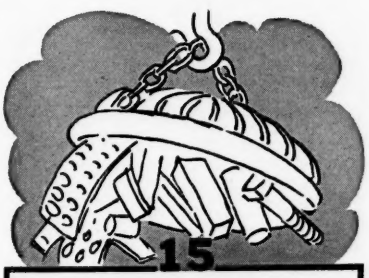
7301 Euclid Ave. Cleveland 3, Ohio

14D-20. Sable pour moulage de Magnésium. (Sand for Casting of Magnesium.) Pierre Nicolas. *Fonderie,* Jan. 1949, p. 1456.

Recommends use of a sand containing 9-12% clay, having an AFS fineness index of about 100, plus 4% sulfur and 0.25% boric acid to create an inert atmosphere.

For additional annotations indexed in other sections, see:

2B-107; 4B-27-34-36; 9-114; 16B-45; 24A-56; 24C-4



15 SCRAP and BYPRODUCT UTILIZATION

15-21. Proifts in Scrap. James Flett. *Iron Age,* v. 163, Mar. 17, 1949, p. 86-90.

Fundamentals of an intelligent scrap program and examples of methods which have enabled many plants to realize substantial scrap profits. Advantages obtainable by careful segregation.

15-22. Waste Disposal. *Chemical Engineering,* v. 56, Mar. 1949, p. 96-119; 144-147.

Symposium deals with varied problems of air and water pollution, including a section on atomic-waste disposal, and a critical review of the Ohio River Valley Compact for governmental control in an eight-state area.

15-23. Baghouse Operation at the Whiting, Indiana Plant of the Federated Metals Division, American Smelting and Refining Company. Julius J. Donoso. *Smoke Prevention Association of America (Proceedings),* 1948, 10 pages.

Bag-filter equipment and procedures used for recovery of lead-smelter fumes.

15-24. Uber die Verhuttung von Neusilberschrott, -abfällen und -spänen. (Entwicklung eines Verdampfungsverfahrens.) (The Melting of Nickel-Silver Scrap, Waste, and Chips. [Development of an Evaporation Process].) Ernst Justus Kohlmeyer. *Zeitschrift fur Erzbergbau und Metallhuttenwesen,* v. 2, Jan. 1949, p. 1-6.

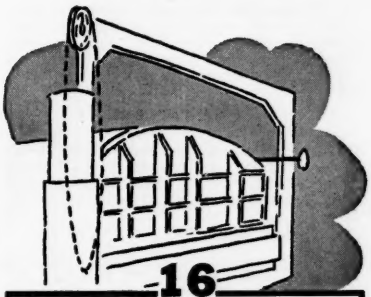
Disadvantages of refining by the converter method and the advantages of the evaporation process. The typical form of the constitution diagram of the Cu-Me-O_2 system, in which Me represents any one of a series of alloying metals. Actual evaporation tests with nickel-silver. This method can also be used to separate zinc from bronze, red-brass, and similar scrap materials. 10 ref.

15-25. Two Variants of Electrolytic Cyanide Waste Disposal. 1. Disposal of Waste Cyanides by Electrolytic Oxidation. R. W. Oyler. **2. Destruction of Cyanide Copper Solutions by Hot Electrolysis.** L. B. Sperry and M. R. Caldwell. *Plating,* v. 36, Apr. 1949, p. 340-347, 412.

Oyler describes a plant process giving details of installation costs. Sperry and Caldwell give results of a laboratory investigation and a plant trial, paying particular attention to the chemistry of the process, and to operating cost. The former employs copper anodes; the latter prefer stainless-steel anodes to carbon-steel anodes and also acid-treat their residues before disposal.

For additional annotations indexed in other sections, see:

2C-22



16 FURNACES and HEATING DEVICES

16A—General

16A-27. Heat Transfer to Liquid Metals Flowing in Asymmetrically Heated Channels. W. B. Harrison and J. R. Menke. *American Society of Mechanical Engineers,* Paper No. 48-A-51, 1948, 14 pages.

Heat transfer to a fluid in turbulent flow between two plane parallel walls is discussed for the case of a system in which the entire heat flux is transferred at one of the walls. Experiments which might yield information on variation of eddy diffusivity near the center line of a channel; a method for predicting heat-transfer coefficients for asymmetrical heat-transfer systems.

16A-28. Verfahren zur Bestimmung der Gesamtstrahlung von Kohlensäure und Wasserdampf in technischen Feuerungen. (Method of Determining the Total Radiation of Carbon Dioxide and Water Vapor in Industrial Furnaces.) C. A. Landfermann. *Stahl und Eisen,* v. 69, Feb. 3, 1949, p. 98-99.

Empirical method of determining the above fails to account for the physical processes of radiation. Explains briefly the physical laws of gas radiation and evolves, on the basis of physical constants, an equation for calculating the radiation of a mixture of CO_2 and H_2O vapor.

16A-29. The Design and Some Construction Details of Two Laboratory Vacuum Furnaces for Casting Metals. Eugene D. Selmanoff. *U. S. Atomic Energy Commission,* MDDC-1126; LADC-279, June 29, 1946, 13 pages.

The first has a tungsten or molybdenum resistance winding. The second uses high-frequency heating, but may be adapted for resistance heating. Both employ bottom-pouring technique. 21 ref.

16A-30. Graphite Resistor Furnace Melting Practice. B. N. Ames and N. A. Kahn. *American Foundrymen's Society,* Preprint No. 52, 1949, 5 pages.

A two-phase furnace utilized in foundries aboard Naval repair ships and in the New York Naval Shipyard foundry. Basic elements of design and operating characteristics and data on the utilization of zircon refractories. Power consumed per

ton of metal melted, melting times for consecutive heats of monel, steel and valve bronze, normal furnace atmospheres generated, and results obtained in the manufacture of pressure castings of monel and valve bronze.

16A-31. A Look at Induction Heating. W. E. Benninghoff. *Steel Processing*, v. 35, Mar. 1949, p. 133-136.

Equipment, procedures, applications.

16A-32. Protective Atmospheres in Industry. Part IV. A. G. Hotchkiss and H. M. Webber. *General Electric Review*, v. 52, Mar. 1949, p. 25-30.

Combusted fuel gas—its uses and properties, costs, manufacture, and distribution. Methods and equipment used in the purification of gases. (To be continued.)

16B—Ferrous

16B-36. Earthquake-Proof Blast Furnace Substructure. *Blast Furnace and Steel Plant*, v. 37, Mar. 1949, p. 360. Also *Iron and Steel Engineer*, v. 26, Mar. 1949, p. 110.

Chilean installation.

16B-37. Continuous Induction Heating Setup Expedites Rock-Bit Forging. W. J. Assel. *Steel*, v. 124, Mar. 28, 1949, p. 66-67.

Utilization of electric induction heating for raising to forging temperature a continuous piece of round bar stock used in the production of removable rock bits.

16B-38. 5-Zone Rotary Furnace Employed to Heat Billets for Piercing. *Steel*, v. 124, Mar. 28, 1949, p. 88, 91-92, 94, 96.

New doughnut-type unit of the National Tube Co. rated at 50 tons per hour when heating sections 8 in. diam. and 16 ft. long to 2350° F. Maximum fuel input when burning either coke oven gas, fuel oil, or natural gas is 1¼ million B.t.u. an hour. Employs automatic charging.

16B-39. Fabricated Pipe Material Production. Arthur Q. Smith. *Industrial Gas*, v. 27, Mar. 1949, p. 10-11, 28-29.

Furnaces used in pipe-fabricating operations.

16B-40. Die Erwärmung von Metallen mittels Hochfrequenz. (Heating Metals With the High-Frequency Current.) A. Leemann. *Zeitschrift fur Schweisstechnik (Journal de la Soudure)*, v. 39, Feb. 1949, p. 33-37.

A comprehensive discussion of the high-frequency method of hardening the surfaces of steel parts. Photographs show different types of inductors, case-hardened machine parts, parts welded with the high-frequency current, and a high-frequency current generator. The effect of wattage per unit area on the depth of case hardening.

16B-41. Gaswirtschaft beim Ein-Hochofen-Betrieb auf Eisenhuttenwerken. 1. Generatorbetrieb eines Hochofens bei einem reinen Hochofenwerk. (Gas Economy in the Operation of a Single Blast Furnace in Steel Plants. 1. Operation of a Blast-Furnace Generator in a Strictly Blast-Furnace Plant.) Alfred Reckmann. 2. **Massnahmen und Erfahrungen beim Ein-Hochofen-Betrieb.** (Methods and Experiences in Operation of a Single Blast Furnace.) Herbert Pohl. 3. **Ein-Hochofen-Betrieb auf einem gemischten Huttenwerk.** (Blast-Furnace Operation in a Diversified Steel Mill.) Henno Franz Strähuber. *Stahl und Eisen*, v. 68, Apr. 22, 1948, p. 151-158.

Part 1: the economics of combining smelting with coking for production of illuminating gas. Part 2: the flow of blast-furnace gas in multi and single-furnace operation. Economy of the system and means of avoiding gas losses. Part 3: a general discussion of the economy of the entire steel plant and the distribution of blast-furnace gas to the various operations.

16B-42. Gasabzugsrohre am Hochofen. (Gas-Exhaust Tubes on the Blast Furnace.) Kurt Guthmann. *Stahl und Eisen*, v. 68, Dec. 2, 1948, p. 481-482.

The problem of wear. Practical suggestions concerning arrangement and optimum tube diameter as well as maximum rate of gas flow. The principal cause of wear is the abrasive action of the flue dust and any means that will reduce the amount of this dust will prolong the life of the tubes.

16B-43. Statistiques des caractéristiques chimiques & physiques des différents cokes sidérurgiques consommés en France & dans divers pays étrangers de 1934 a fin Décembre 1947. (Statistics Concerning the Physical and Chemical Characteristics of Different Metallurgical Cokes Used in France and Other Foreign Countries During the Period 1934-1947, Inclusive.) C. G. Thibaut. *L'Institut de Recherches de la Sidérurgie (IRSID)*, (Saint-Germain-en-Laye, France), ser. A, no. 3, Sept. 1948, 21 pages.

Presents in tabular form information for France, Belgium, Germany, Saar Region, Holland, and Great Britain.

16B-44. Method of Utilization of Heat From the Cooling Water in Open-hearth-Furnace Installations. (In Russian.) A. D. Akimenko and P. G. Sedov. *Promyshlennaya Energetika* (Industrial Power), v. 5, Dec. 1948, p. 6-8.

Theoretically indicates possibility. Proposes a scheme of utilization based on obtained theoretical data.

16B-45. Fours électriques de fusion de la fonte. (Electric Furnaces for Melting of Cast Iron.) Gabriel Joly. *Fonderie*, Jan. 1949, p. 1456-1457.

Details of radiant-arc and graphite-electrode types. Advantages and disadvantages of each.

16B-46. The Production Aspects of Fuel Efficiency at Corby Iron and Steel Works. A. Stirling. *Journal of the Institute of Fuel*, v. 22, Feb. 1949, p. 166-174.

The principal characteristics of the lean Northamptonshire ores which are of practical importance in ironmaking and the need for close control of crushing and blending. Deterioration in recent years in the quality of coking slacks and metallurgical coke in relation to their effect on coke usage in the Corby blast furnaces. The principles of acid burdening; and the consistency of heat input to the blast furnaces when allowance is made for ash content of the coke. Full-scale experimental data for a heat balance in a modern basic bessemer converter. 15 ref.

16B-47. Modern Heating Methods for the Steel Forge Plant. Charles C. Eeles. *Steel Processing*, v. 35, Mar. 1949, p. 149-154, 161-162.

Modern furnace equipment of various types for various jobs. Advantages of gas-oil fired equipment for forge heating.

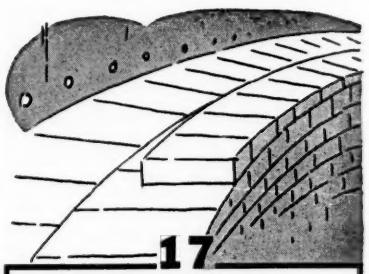
16B-48. Chemical Process Simplifies Cleaning of Gas Washers and Precipitators. J. M. Howell. *Steel*, v. 124, Apr. 11, 1949, p. 101-102, 104, 107.

Method for servicing blast-furnace gas-cleaning equipment without interrupting operation of vessel or slacking of blast. Technique removes scale and sludge from wet and dry units.

16B-49. Heating Seamless Tubes for Sizing. *Iron Age*, v. 163, Apr. 14, 1949, p. 86-88.

Continuous tube reheating equipment of special design. The 13 heating furnaces are of cylindrical construction, and each has a heating chamber equipped with 16 burners, each containing a tip with a number of accurately-sized, uniform ports. From these ports the gas-air mixture is directed so that each flame sweeps the surface of the burner-cup cavity which acts as a radiant surface.

For additional annotations indexed in other sections, see:
2B-116; 18A-13



17 REFRACTORIES and FURNACE MATERIALS

17-23. Gary Steel Works Disintegration Test Equipment. J. A. Shea. *Blast Furnace and Steel Plant*, v. 37, Mar. 1949, p. 380. A condensation.

Semi-automatic equipment for making disintegration tests on blast-furnace lining bricks and a suitable test procedure.

17-24. Expansion Effects in Coke-Oven Batteries. *Coke and Gas*, v. 11, Mar. 1949, p. 101-107.

Analyzes the differential expansions that occur during heating up coke-oven batteries constructed in two different types of material, silica and semi-silica.

17-25. Preliminary Investigations Into Coring of Fireclay Refractories. K. W. Cowling and A. Elliott. *Transactions of the British Ceramic Society*, v. 48, Mar. 1949, p. 108-124; discussion, p. 124-131.

Investigation of outbreaks of black-hearting in casting-pit refractories fired in tunnel kilns shows that the major factor affecting this is a change in texture of the ware, leading to decreased porosity and to the formation of a relatively high percentage of closed pores. Causes of this. 14 ref.

17-26. Vergleichsmessungen an zwei Versuchsofen mit verschiedener Ausmauerung. (Comparative Measurements on Two Test Furnaces With Different Linings.) Georg Wagener. *Gas- und Wasserfach*, v. 89, No. 2, 1948, p. 33-36.

Investigation of the relative efficiency of fireclay and light-weight firebrick.

17-27. Erfahrungen in der Herstellung von Huttensteinen. (Experiences in the Production of Refractory Brick.) Paul Huttemann. *Stahl und Eisen*, v. 68, Feb. 26, 1948, p. 85-90.

Some technical problems in the production of refractory brick from foundry slag and foundry sand. Deals in detail with Dresler's ideas on the hardening process with CO_2 and with the factors that influence the strength of refractory brick.

17-28. Properties and Uses of Pure Oxide Heavy Refractories. O. J. Whittemore, Jr. *Industrial Heating*, v. 16, Mar. 1949, p. 496, 498. A condensation.

Physical properties of alumina, magnesia, zirconia, beryllia, and

thoria. Recommendations for their use at high temperatures.

17-29. Effect of Oxygen on Refractories in the Basic Open Hearth Furnace. R. S. Moore. *Industrial Heating,* v. 16, Mar. 1949, p. 500, 502. A condensation.

Reaction of some refractories to the use of oxygen, methods of supplying oxygen to the molten bath, merits of super-duty silica brick in the roof, roof suspension, and effect of oxygen on the furnace walls.

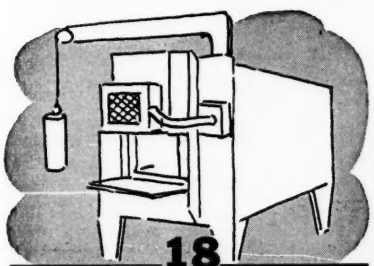
17-30. The Preparation of Small Dense Beryllia Crucibles. O. J. Whittemore, Jr. *U. S. Atomic Energy Commission,* AECD-2175, Dec. 1945, 9 pages.

Procedure. Effect of calcination and ball-milling on particle-size and their relation to final crucible properties. Use of "Daxad No. 23" as an anti-sticking agent.

17-31. (Book) Refractories for Furnaces, Kilns, Retorts, etc. Ed. 2. (Rev.) Alfred B. Searle. 121 pages. 1948. Crosby Lockwood & Son, Ltd., 20, Tudor Street, London, E.C.4, England.

Characteristics of the chief raw and manufactured refractory materials and the processes and machinery employed in their production. An elementary presentation.

For additional annotations indexed in other sections, see:
3B-73



18 HEAT TREATMENT

18A—General

18A-8. Production Line Heat Treating. H. M. Heyn. *Industrial Gas,* v. 27, Mar. 1949, p. 5-7, 24.

By "barrel carburization" many parts previously carburized in batch or continuous furnaces may now be carburized in "barrels" in much the same way as barrels are used for cleaning and electroplating. Parts are heated, carburized, quenched, washed, reheated, quenched and drawn by a continuous method.

18A-9. Planung und Betriebswirtschaft in der Wärmebehandlung. (Planning and Economy of Heat Treating Operations.) Helmut Schneider. *Stahl und Eisen,* v. 68, Dec. 2, 1948, p. 479-481.

How to plan and perform heat treating operations with a high degree of efficiency; how to calculate the cost of heat treating.

18A-10. Aus der Praxis der autogenen Oberflächen-härtung. (Practical Flame Hardening.) B. F. Gorthon. *Zeitschrift fur Schweisstechnik; Journal de la Soudure,* v. 39, Feb. 1949, p. 29-33.

Different types of flame-hardening machines. Composition of steel suitable for flame hardening and the range of application of the three most important flame-hardening processes. Strength properties.

18A-11. Der Einfluss der Wärmebehandlung auf die Härte und die Gasgehalte der Hartchromschichten. (The Effect of Heat Treating on the Hardness and Gas Content of Hard Chromium Deposits.) Walter Eilender, Heinrich Arend, and Eugen Schmidtmann. *Metalloberfläche,* v. 2, July 1948, p. 143-145.

Studies show that hardness and hydrogen content decrease with increasing temperature, that no heat treating operation can alter the oxygen content of the Cr, and that hardness drops with heat treating time at a decreasing rate. 12 ref.

18A-12. How to Handle Parts in Induction Heating. Clarence E. Glick and Roger E. Harlepp. *American Machinist,* v. 93, Apr. 7, 1949, p. 92-96.

Typical fixtures designed for heat treating, soldering, brazing, forging, and shrink-fitting illustrate basic principles.

18A-13. Controlled Atmospheres. *Journal of the Birmingham Metallurgical Society,* v. 28, Dec. 1948, p. 281-295; discussion, p. 296-304.

Extended remarks by P. F. Hancock dealing mainly with actual plant practice and by R. Whitfield on chemical and metallurgical aspects, followed by a general discussion.

18A-14. Die autogene Oberflächenhärtung; La trempe superficielle au chalumeau. (Flame Hardening.) H. Bauer. *Zeitschrift fur Schweisstechnik; Journal de la Soudure,* v. 39, Feb. 1949, p. 21-28.

Physical principles and advantages. Spot hardening, case hardening, line hardening, and annular hardening methods of carbon and alloy steels. (To be continued.)

18B—Ferrous

18B-54. Report of Graphitization Studies on High-Temperature Welded Piping of the Philadelphia Electric Company. J. B. Abele and A. E. White. *American Society of Mechanical Engineers,* Paper No. 48-A-94, 1948, 23 pages.

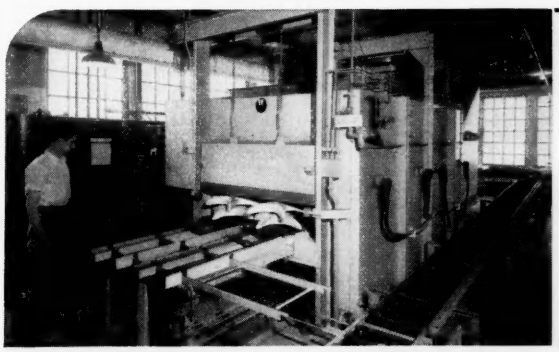
Investigations of weld sections from plain carbon steel piping. Results of a tension test on a weld section in a 4 million-lb. machine. Gives procedure used for solution treating followed by stress relief of 29 weld sections, and physical-test results after such treatment and subsequent service. Results demonstrate the practicability of restoring lightly or moderately graphitized weld sections by a rapid and relatively low-cost method.

18B-55. Einfluss der Erhitzungsgeschwindigkeit des Stahles auf die Perlit-Austenit-Umwandlung unter besonderer Berucksichtigung der Oberflächenhärtung. (Effect of the Heating Rate of Steel on the Pearlite-Austenite Transformation With Special Reference to Surface Hardening.) Walter Eilender and Robert Mintrop. *Stahl und Eisen,* v. 68, Feb. 26, 1948, p. 83-85.

A brief report. The experiments were made with 0.54% C steel.

18B-56. Untersuchungen uber die Anwendbarkeit der Zwischenstufenvergutung. (Research on the Applicability of Intermediate Temperature Annealing.) Winfried Connert and Heinz Kiessler. *Stahl und Eisen,* v. 68, Apr. 22, 1948, p. 137-151.

The Brinell hardness and impact toughness of a steel (0.45% C, 1.4% Si, 0.9% Mn, and 1.1% Cr) annealed



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3 hr. and quenched in salt baths at 200-400° C. were investigated; also the effect on toughness. Range of application of intermediate-temperature annealing. 20 ref.

18B-57. Einfluss der Anlasszeit auf die Härte von Werkzeugstahl. (Effect of Annealing Time on the Hardness of Toolsteel.) Alfred Krisch. *Stahl und Eisen,* v. 68, Apr. 22, 1948, p. 165.

Effect of annealing 1000 hr. at 50-270° C. on the hardness of different types of toolsteels.

18B-58. Die Ruckbildung der Aushärtung von Eisen-Kohlenstoff-Legierungen. (The Reversal of Age-Hardening of Iron-Carbon Alloys.) Werner Geller and Herbert Kuntze. *Zeitschrift fur Metallkunde,* v. 40, Jan. 1949, p. 16-24.

Property changes caused by age hardening. The effect of room-temperature age hardening on the hardness of two low-carbon steels. Age-hardening reversal tests were made at temperatures of 100-400° C. The difference between cold and hot age hardening. 21 ref.

18B-59. Increased Wear Resistance by Induction Hardening. Joseph F. Libsch. *Metal Progress,* v. 55, Mar. 1949, p. 34.

Experimental work to explain the fact that cylinder liners made of induction hardened 0.50% Cr, 0.55% C steel appear to stand up in service as well as high-carbon carburized liners. Satisfactory performance can be expected because of the presence of undissolved alloy carbides in the hardened structure. The phase transformations involved.

18B-60. Heat Treatment of Forgings and Die Blocks at A. Finkl & Sons Co. III. (Concluded.) *Industrial Heating,* v. 16, Mar. 1949, p. 416-418.

Describes and illustrates Heat Treat Plant No. 4.

18B-61. Controlled Atmosphere Annealing of Malleable Iron. *American Foundrymen's Society,* Preprint No. 45, 1949, 3 pages.

Study of the literature and a survey of the practices. 32 ref.

18B-62. Graphitization of Gray Cast Iron by Heat Treatment. A. W. Silvester. *American Foundrymen's Society,* Preprint No. 40, 1949, 15 pages.

The time which combined carbon took to decompose at various temperatures. The graphitization rate of a sample of medium Si content was compared with one of high Si content.

18B-63. Practical Pointers on Steel Treating. Part IV. W. R. Bennett. *Modern Machine Shop,* v. 21, Apr. 1949, p. 116-118, 120, 122, 124, 126, 128, 130.

Formation of decarburized surfaces as a result of pack hardening.

18B-64. Protective Atmospheres in Industry. Part V. A. G. Hotchkiss and H. M. Webber. *General Electric Review,* v. 52, Apr. 1949, p. 25-28.

Effects of furnace atmospheres of H_2, N_2, CO_2, or dissociated NH_3 in preventing decarburization in various heating processes. Photomicrographs of steel heat treated in different atmospheres. (To be continued.)

18B-65. New Process for Alloying Chrome With Steel Surface Gives Superior Die for Zinc. A. Berger. *Die Castings,* v. 7, Apr. 1949, p. 40-41.

Reviews previous attempts. Process developed by R. L. Samuels involves packing steel in carburizing boxes together with a chromium-rich powder and subjecting the boxes to heat treatment in an ordinary gas furnace for 3-6 hr. depending upon the depth of penetration desired.

18B-66. Automatic Flame Hardening Steps Up Production of Steel Cams. Herbert Chase. *Materials & Methods,* v. 29, Apr. 1949, p. 47-49.

Method, equipment, and results obtained by Buick. On a cam ring having eight internal recesses, the inclined surfaces must be hardened while adjacent areas must remain soft.

18B-67. Specific Work Areas Surface Hardened by Concentrated Flame Method. Jay DeEulis. *Steel,* v. 124, Apr. 11, 1949, p. 86-88.

Full-scale industrial tool which enables heat treaters to selectively pin-point the flame to the exact portion to be hardened.

18B-68. Structural Steels. Quintin C. McMillan. *Iron and Steel,* v. 22, Mar. 1949, p. 105-108.

Application of hardenability theory to large-scale practice. Mechanical handling and marquenching. (To be concluded.)

18B-69. Gas Cyaniding of High-Speed Steels. (In Russian.) A. P. Garashchenko. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Nov. 1948, p. 17-19.

Different methods and the method used in the USSR since 1940. Optimum conditions for different types of toolsteel.

18B-70. Technology of Hardening of Cutting Tools. (In Russian.) B. M. Askinazi. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Dec. 1948, p. 12-15.

Methods of hardening cutting instruments, emphasizing the high-frequency heat treatment which secures minimum deformation of the instrument and does not produce decarburization of the surface layer, since the heating lasts only a few seconds. Diagrams of equipment.

18B-71. Isothermal Treatment of Low-Alloy Steels. *Engineer,* v. 187, Mar. 25, 1949, p. 328-329. Translated and condensed from paper by Anton Pomp and Erich Rolf, *Archiv fur das Eisenhuttenwesen,* v. 19, 1948, p. 197-202.

Results of notched-bar and hardness tests on samples of a 1.8% Mn and a Cr-V steel cooled from various temperatures and transformed isothermally at different temperatures. For comparison, tests were made on steels treated in the conventional way, that is, hardened and tempered at the temperature used in the isothermal transformation.

18B-72. Reflections on Yielding and Aging of Mild Steel. II. The Strain-Aging of Steel. (In English.) J. H. Palm. *Metalen,* v. 3, Feb. 1949, p. 120-126.

Concludes critical review of the literature. Comparison of strain-aging and quench aging and their causes; the mechanism of strain aging; and blue brittleness. 64 ref.

18B-73. Prufung der Abschreckhärtbarkeit von Stahl an Plättchen. (Testing the Quenching Hardenability of Steel by Use of Small Flat-Plate Specimens.) Helmut Krainer, Karl Swoboda, and Franz Rapatz. *Stahl und Eisen,* v. 69, Feb. 17, 1949, p. 122-127.

Investigates the suitability of small steel plates (20 x 50 x 2-3 mm.) for determining the hardenability of steel. Photomicrographs show the structures of different steels quenched from different temperatures. 11 ref.

18D—Light Metals

18D-7. Thermal Treatment of Aluminum Alloys. E. H. Dix, Jr. *American Society for Metals,* "Physical Metallurgy of Aluminum Alloys," 1949, p. 200-240.

Summarizes objectives; describes terms; and discusses treatments under the headings: annealing; recovery; preheating; solution heat treatment; quenching; aging; and reheating. Effects of thermal treatment on corrosion resistance and an explanation of the Alcoa temper designation for cast and wrought products. 36 ref.

For additional annotations indexed in other sections, see:

3B-68-73; 4B-31; 6D-16; 16B-40; 19B-63

19 WORKING

19A—General

19A-72. Automatic Control of Tension, Speed, and Position in Handling Metal Strip. J. H. Hopper. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 317-322, 386-388.

Apparatus for the above.

19A-73. Water Lubrication of Phenolic Bearings. Part II. Frank Vogt. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 338-341.

Recommended procedures for bearings on large machinery.

19A-74. Edge Positioner. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 341-342.

Edge position of any sheet-like material entering a process over rollers can now be controlled within limits as narrow as ±0.05 in. by simple mechanical means and without touching the sheet.

19A-75. New Facilities at Gary Sheet and Tin Mill Offer Increased Tin Plate Capacity. *Steel,* v. 124, Mar. 28, 1949, p. 86, 103, 106, 108.

Extensive additions of new equipment and revision and replacement of existing facilities.

19A-76. The Reversing Cluster Mill. G. E. Farrington. *Iron and Steel Engineer,* v. 26, Mar. 1949, p. 69-71.

Mill enables operator to obtain the larger reductions afforded by small work rolls and at the same time retain the greater rigidity inherent in larger rolls.

19A-77. The Art of Rolling Flats. Charles P. Hammond. *Iron and Steel Engineer,* v. 26, Mar. 1949, p. 85-95; discussion, p. 95.

Rolling procedure for the production of flats with particular attention to the effect of roll design.

19A-78. Extensometer Indicates Strip Extension. G. H. Rendel. *Iron and Steel Engineer,* v. 26, Mar. 1949, p. 113.

Unique type of continuously indicating and recording extensometer for measuring the percentage of extension of strip during rolling in temper pass mills.

19A-79. Extensometer Indicates and Records Percentage of Extension on Strip Temper Pass Mill. G. H. Rendel. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 382.

See item 19A-78.

19A-80. Designing of "Trouble-Free"

Dies. Part XCI. Types of Presses, Their Uses and Capacities. C. W. Hinman. *Modern Industrial Press,* v. 11, Mar. 1949, p. 22, 40.

Multiple-plunger eyelet machines.

19A-81. Quality Plate Fabrication at General American Transportation Corporation. Walter Rudolph. *Modern Industrial Press,* v. 11, Mar. 1949, p. 24, 26, 30, 32.

Forming, shearing, punching, welding, and other procedures and equipment in fabrication of railway tank cars and other large vessels in both steel and aluminum.

19A-82. Modern Press Department Speeds Production of Friden Calculating Machines. J. Delamar Harrell. *Modern Industrial Press,* v. 11, Mar. 1949, p. 34, 36, 38, 40.

Described and illustrated.

19A-83. Highly Specialized Press Production at Korry Mfg. Company. Howard E. Jackson. *Modern Industrial Press,* v. 11, Mar. 1949, p. 42, 44, 46.

Manufacture of indicator lights for both military and commercial airplanes.

19A-84. Erkenntnisstand auf dem Gebiete der Warmverformung. (Present Knowledge in the Field of Hot Working.) Theodor Dahl. *Stahl und Eisen,* v. 68, Sept. 9, 1948, p. 333-345.

An extensive summary review. 40 ref.

19A-85. Entwicklung der Walzenanstellvorrichtungen fur Feinblechwalzwerke. (Development of Roll-Adjusting Equipment for Sheet-Metal Rolling Mills.) Wilhelm Krämer. *Stahl und Eisen,* v. 69, Feb. 3, 1949, p. 86-93.

Control and adjusting devices for old and modern rolling mills.

19A-86. Residual Stresses During Flaring. (In Russian.) L. A. Glikman and V. A. Stepanov. *Kotloturbostroenie* (Boiler and Turbine Industry), Sept.-Oct. 1948, p. 29-32.

Continuation of preceding work on experimental investigation of the above. Mechanism involved.

19A-87. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 531-534, 539.

New materials; possible developments and future trends. Various defects in ferrous metals as related to performance in press operations. Die steels and their recommended heat treatments. Other ferrous and nonferrous materials used, their advantages and disadvantages, including hard-faced and plated tools. (To be continued.)

19A-88. A Practical Workshop System for the Care and Maintenance of Press Tools. (Continued.) W. M. Halliday. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 561-568; Apr. 1949, p. 788-796.

Deals with following specific types: die blocks (solid type), sectional or built-up die blocks, sectional die blocks for pointers, an eight-section die block, and solid-type punches. (To be continued.)

19A-89. The Art of Roll Pass Design. Ross E. Beynon. *Steel,* v. 124, Apr. 4, 1949, p. 112, 114, 117-118, 120, 123-124.

19A-90. Fundamental Principles of Drawing Dies. II. C. W. Hinman. *Machine and Tool Blue Book,* v. 45, Apr. 1949, p. 115-116, 118-120.

Drawing presses in action. A step-by-step description of the drawing of ten-gallon stock-pots (three-draw operation) applies the principles discussed in the first article.

19A-91. Estimating Upset Forgings. III-V. Albert P. Berberich. *American Machinist,* v. 93, Apr. 7, 1949, p. 135, 137, 139.

A tabulation covering stock of diameters of 1¼ to 5 13/64 in. in diam. for various lengths to upset. Diameters and lengths after 1st, 2nd, and 3rd pass.

19A-92. Dial Feeds for Punch Presses. *Machinery,* v. 55, Apr. 1949, p. 176-177.

Improved dial-feed presses are said to enable an operator to handle four to six times as much work as on conventional presses. A variety of secondary operations may be done on these presses.

19A-93. Cold Rolling Technique. IV Simplified Rolling Mill Calculations. Hugh Ford. *Sheet Metal Industries,* v. 26, Apr. 1949, p. 733-741.

Lever-arm method, with details of its theoretical development, and results of calculation compared with experimental results for 0.2% C steel and for high-conductivity copper. (To be continued.)

19A-94. Westinghouse Reports on Carbide Dies. Gilbert P. Muir. *Tool Engineer,* v. 22, Apr. 1949, p. 17-20.

Use in punch-press operations. Production records and comparative cost data.

19A-95. Dies for Swaging Operations. John Mueller. *Tool Engineer,* v. 22, Apr. 1949, p. 28-30.

Recommended designs for typical jobs.

19A-96. Design and Manufacture of Forming Rolls. A. W. Baumgartner. *Tool Engineer,* v. 22 Apr. 1949, p. 35-36.

For three typical jobs. Primary rolls are solid steel, while the inside section of finishing rolls is bronze to prevent marring or scoring.

19A-97. Rolls and Rolling. Parts III and IV. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 325-334; Apr. 1949, p. 435-441.

Part III continues description and diagrammatic representation of roll profiles. The three-high blooming mill; specialized blooming design for beam blanks; two-high continuous mill; and high-lift bloomer. Part IV discusses "ragging"—used to eliminate slipping and permit heavier drafts. The three-high billet mill. (To be continued.)

19A-98. Forging Alloys for High Temperature Service. L. S. Fulton. *Materials & Methods,* v. 29, Apr. 1949, p. 50-53.

Production of forging billets, classes of above alloys, and forging methods and equipment. Compositions of typical Fe, Ni, and Co-base forging alloys. Applications of the different types.

19A-99. A New Process for Forming and Closing Tube Ends. A. L. Williams. *Machinery* (London), v. 74, Mar. 24, 1949, p. 383-384.

American Westin process. Equipment consists essentially of a welding transformer and a split forming die, to which electrical current is supplied by the transformer. Tubes ranging 1/16-⅜ in. wall thickness and ¾-16 in. diam. are considered to be within practical forming limits.

19A-100. Wissenschaft und Praxis im Stabziehereibetrieb. (Science and Practice in the Rod-Drawing Industry.) Fritz Boehm. *Stahl und Eisen,* v. 69, Feb. 17, 1949, p. 105-117.

Practical application of scientific theories, demonstrating flow of metal through the die. Calculates the required energy with respect to such factors as type of material, shape of die, friction, etc. The effect of area reduction, of the taper of the die hole, and of the index of friction on the "drawing energy" and on the loss of energy are expressed by Korber and Eichinger's and Siebel's approximation formulas. 33 ref.

19A-101. The Use of Hard Metals for Blanking Tools. René Champeval. *Microtecnic* (English Edition), v. 3, Jan.-Feb. 1949, p. 34-37. Translated from the German.

Advantages of use of hard metal, recommended procedures and typical tools of this type.

19A-102. Les procédés de fabrication des usines metallurgiques suisses. 5. Le laminage; Die Verarbeitungsverfahren der Schweizerischen Metallwerke. 5. Walzen. (Production Methods in Swiss Metal Works. 5. Rolling Practice.) O. H. C. Messner. *Pro-Metal,* v. 2, Feb. 1949, p. 293-303.

Different types of rolling mills and the methods of rolling ferrous and nonferrous metals.

19B—Ferrous

19B-50. Crucible Steel Company of America Completes Improvements at Spaulding Works. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 343-344.

New equipment for cold rolling and inspection.

19B-51. Shoes for the Iron Horse. *Western Machinery and Steel World,* v. 40, Mar. 1949, p. 90-92.

Rolling and press operations in production of railroad tie plates.

19B-52. Republic Steel Products Flow From Western Plant. *Western Metals,* v. 7, Mar. 1949, p. 19-21.

Procedures and equipment for producing cold-drawn steel in a wide variety of smaller sizes and shapes. Principal equipment includes draw-benches; wire blocks; equipment for straightening and cutting bars and straightening wire; turning machines; grinders for wire sizes; and centerless grinders.

19B-53. Residual Stresses in Rolled Sheet. Ya. S. Gallai, M. I. Zlotnikov, and N. N. Sokolovski. *Engineers' Digest,* v. 10, Feb. 1949, p. 41-42. Translated and condensed from *Stal* (Steel), No. 1, 1948, p. 37-45.

Test results for five low-alloy steels (compositions given) shown graphically and discussed.

19B-54. A Review of the Application and Design of Heavy Forging Presses. J. A. Sanderson and J. G. Frith. *Journal of the Iron and Steel Institute,* v. 161, Mar. 1949, p. 231-246.

Present-day forging practice; tendency toward larger ingot sizes, and the probable press powers required to deal with these ingots. Details of the size and location of existing heavy presses, together with lists of ingot capacities of the various sizes both for forging and upsetting. British and American practice compared. Various methods of press construction.

19B-55. Technical Developments in the Manufacture of Full Finish Steel Sheets. W. H. R. Bird. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 513-524.

Development of the modern full finish or auto-body steel sheet—improvement in sheet surface, and improvement in drawability. The aspect of surface in relation to steelmaking technique and to rolling and processing into sheets. Effect of chemical analysis, practical limits of purity in steelmaking, and effect of segregation in rimming steels on drawability. The problem of strain-age hardening in rimming steels; recent developments in non-aging steels.

19B-56. Five Presses Linked Automatically Speed Output of Ford Axle Housings. P. D. Aird. *Modern Industrial Press,* v. 11, Mar. 1949, p.13-14, 17-18, 40.

Described and illustrated.

19B-57. Hand-Molding Kettle Covers. *Sheet Metal Worker,* v. 40, Mar. 1949, p. 46, 48.

Methods for shaping and machining stainless-steel kettle tops 12½ ft. in circumference.

19B-58. Phosphate Coatings; Developments in Wire, Tube and Deep Drawing Applications. H. A. Holden and S. J. Scouse. *Automobile Engineer,* v. 39, Mar. 1949, p. 107-113.

See abstract from *Sheet Metal Industries,* item 19B-28, 1949.

19B-59. Erfahrungen beim Ziehen von dunnen Stahldrähten mit hoher Ziehgeschwindigkeit. (Experiences in the High-Speed Drawing of Thin Steel Wires.) Clemens Eisenhuth. *Stahl und Eisen,* v. 68, Jan. 29, 1948, p. 46-48.

With the aid of special machines it is possible to increase the rate of drawing of fine high-quality steel wires. Equipment and data.

19B-60. Cold Forming Stainless Steels. Lester F. Spencer. *Iron Age,* v. 163, Mar. 31, 1949, p. 58-64; Apr. 7, 1949, p. 93-99.

Part one: cold-forming techniques suitable for various grades of stainless. Stamping, drawing, bending, blanking, punching, bulging, etc. Part two: further modifications of drawing methods, annealing, pickling, tool materials, lubricants, and other pertinent factors.

19B-61. Making the Morris Minor Body. *Machinery* (London), v. 74, Mar. 17, 1949, p. 323-329.

Various press operations in production of small-sized British automobile.

19B-62. Making Aluminum Furniture From Extruded Tubing. *Machinery,* v. 55, Apr. 1949, p. 158-159.

19B-63. Crucible Steel Co. Completes Expansion of Cold Rolling Plant. *Machinery,* v. 55, Apr. 1949, p. 175-176.

Rolling and heat-treating equipment.

19B-64. Helve Hammer Forging Done to .001" Tolerances. John C. McComb. *Steel Processing,* v. 35, Mar. 1949, p. 129-132.

Methods and equipment for accomplishing on special toolsteels. Principal items of manufacture are chisels, rivet sets, paving breakers, hollow drill steels.

19B-65. Hot Extrusion Methods Applied to Automotive Parts. Claud L. Stevens and Gustav Vennerholm. *Steel,* v. 124, Apr. 11, 1949, p. 82-85, 110.

Technique adopted by Ford. Economic and engineering advantages are said to be savings of 30% in steel, 65% labor, 80% floor space, 40% die costs, and excellent fiber flow conditions. Die design, cold sheared billets, high-temperature salt bath, and die cooling.

19B-66. Application of a Microhardness Method to Evaluation of the Cold Working of Surface Layers of the Sides of a Drilled Hole. (In Russian.) M. Ya. Freidkin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1450-1455.

Experimentally confirms the applicability of the technique. As a result of drilling, a thin surface layer of cold worked metal having hardnesses considerably in excess of that of the base material is formed.

19B-67. Distribution of Cold Hardening Around a Conic Impression. (In Russian.) F. S. Savitskii, B. A. Vandyshev, and M. V. Yakutovich. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1476-1479.

The distribution of cold hardening in the part of the test specimen deformed by the conical indenter. Methods of investigation.

19C—Nonferrous

19C-9. Brass Rods. U. M. Evans. *Iron Age,* v. 163, Apr. 14, 1949, p. 66-69.

Drawing, straightening, cutting to length, and polishing of the above. Capable of handling rounds in sizes from ⅜ to 1 in. and square and hexagon stock in sizes from ⅜ to ⅞ in., this unit produces finished stock at a rate approximately double that of conventional draw benches and triple that of other types of continuous drawbenches.

19C-10. Rod Finishing; The "Lomatic" Combined Drawing, Cutting and Straightening Machine. John Rae, Jr., and Leslie Miller. *Metal Industry,* v. 74, Mar. 25, 1949, p. 229-232.

Machine for producing round, square, and hexagon-shaped brass rods.

19C-11. Development of the Zone of Plastic Deformation and Cold Hardening During Deformation of Metal in the Presence of Surface-Active Substances. (In Russian.) T. Yu. Lubimova, P. A. Rebinder, and L. A. Shreiner. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Nov. 21, 1948, p. 293-295.

Investigated on polycrystalline zinc and copper using a specially developed test apparatus. A 0.1% solution of stearic acid in kerosene and a 0.2% solution of oleic acid in vaseline oil were used as surface-active media. Surface hardness of cold worked zinc increases 1.5 times as much as that of copper without agents and two times when such agents are used. Causes of the phenomenon. Influence of other factors, such as time and temperature.

19D—Light Metals

19D-26. Impact Extruding Aluminum. *Steel,* v. 124, Mar. 28, 1949, p. 72-76.

Opportunities for reducing costs and improving product design. Outlines five major steps in impact extrusion process.

19D-27. Design for Forging; Application to High Strength Aluminium Alloys. *Metallurgia,* v. 39, Feb. 1949, p. 191-194. Reprinted from *Hawker Siddeley Review,* Aug. 1948.

Forging process; design, production, and mechanical properties of forgings; close-to-form stampings.

19D-28. Impact Extrusion of Aluminum. John L. Everhart. *Modern Metals,* v. 5, Mar. 1949, p. 23-25.

See abstract from *American Machinist,* item 19d-62, 1948.

19D-29. Uber die Verformung des Magnesiums und seiner Legierungen. (On the Deformation of Magnesium and Its Alloys.) Theodor Ernst and Fritz Laves. *Zeitschrift fur Metallkunde,* v. 40, Jan. 1949, p. 1-12.

Effects of forging and rolling on structures. Resulting deformations were examined metallographically with special etchants. Results indicate the possibility of "fracture slippage", a combination of fracture and translation phenomena.

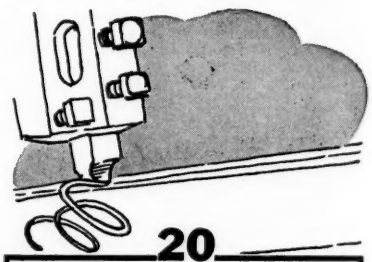
19D-30. Three-Dimensional Routing. *Aircraft Production,* v. 11, Apr. 1949, p. 111-114.

Routing was adopted in air-frame manufacture as a rapid means of shaping light-alloy sheet-metal parts without expensive press tools, which the quantities required would not justify. In the normal routing process, the material is removed by the side or periphery of the routing tool. Describes an "end" routing process (cutting with the end of the routing tool in the manner of an end-mill) which process has been adapted to the trimming of single or double curvatures requiring the cutter to follow a three-dimensional path. Equipment modifications, procedures, and applications.

19D-31. Punch Press Tools for Cutting. J. W. Lengbridge. *Tool Engineer,* v. 22, Apr. 1949, p. 37-40.

Installment No. 12 of a series on the theory and practice of pressing aluminum. Fundamentals of press cutting, clearance and controlling factors, and effect of clearance on size. Specific data on clearance for aluminum, and approximate data on copper, brass, and steel.

For additional annotations indexed in other sections, see:
3B-61; 11-109; 16B-37-47; 20D-10; 22D-28; 24A-51



20
MACHINING and MACHINABILITY

20A—General

20A-136. Crush-Ground Profiles Cut Plug Costs. C. D. Caulton and J. E. Safhill. *American Machinist,* v. 93, Mar. 24, 1949, p. 98-99.

How crush grinding reduces tool costs 50% and more, improves quality, and gives longer tool life between grinds in manufacture of switchboard plugs in England.

20A-137. Straight Cut-Off Blades. *American Machinist,* v. 93, Mar. 24, 1949, p. 145.

American Standard ASA B5.21-1949 developed by ASME. It covers straight cut-off blades for lathes and screw machines.

20A-138. Practical Ideas. *American Machinist,* v. 93, Mar. 24, 1949, p. 125-130.

Includes the following: heavy sine plate for mounting light grinding work (Allan B. Nixon); multi-bit tooling replaces solid tool for boring long cylinders (Arthur Silvestor); double-tool setup for cutting double threads (Wilson A. Beard); stepped plug gage as aid to fine-tolerance internal grinding (G. R. Milner); adjustable gage for checking internal grooves (S. R. Welling); production of beveled edges on spur gears on a milling machine (C. D. Mackinnon); vise squeezing extends life of boring bit (G. R. Milner); tapered-sleeve stop for short work chucked in the lathe (Grover C. Russell); strip-steel notching permits continuous lithography on oil-filter covers (Chester S. Ricker); chuck centers air gun used to center drill billets (K. C. Bland); ring gages for checking taper against master plug (C. D. Mackinnon); and other miscellaneous shop hints.

20A-139. Automatic Balancing of Grinding Wheels. *Industrial Diamond Review,* new ser., v. 9, Feb. 1949, p. 38. Based on pamphlet by A. H. Dall.

Device which consists of a hollow ring containing three balls, which, when rotated, bring the wheel into a balanced position. The balls are afterwards clamped so that the wheel remains in this position.

20A-140. Cromwell 3½ in. Precision Lathe. *Industrial Diamond Review,* new ser., v. 9, Feb. 1949, p. 39-43.

Description of machine tool. Typical production results on duralumin and phosphor bronze.

20A-141. Effective Station to Station Motions; Key to Further Machining Productivity. Ralph E. Cross. *Steel,* v. 124, Mar. 28, 1949, p. 70, 85.

Advantages of transfer mechanism to carry work from one station to another on multiple-station tools; each station is a machine in itself.

20A-142. Harnessed Hydraulic and Pneumatic Power. *Western Machinery and Steel World,* v. 40, Mar. 1949, p. 93-95.

Machine-shop operations in manufacture of pneumatic and hydraulic cylinders and valves. Steel and aluminum are used.

20A-143. The Production Machine Shop and Broaching Member. *Western Machinery and Steel World,* v. 40, Mar. 1949, p. 103.

Procedures and equipment of Harford Manufacturing and Broaching Co.

20A-144. "Bandurko" Type Screw-Cutting Head for Pipes. B. A. Kurenkov. *Engineers' Digest,* v. 10, Feb. 1949, p. 61-62. Translated and condensed from *Stanki i Instrument* (Machine Tools and Instruments), Dec. 1947, p. 12-16.

New design claimed to have several advantages.

20A-145. Bar Extension Tubes for Capstan Lathes and Automatics. W. F. Troescher. *Engineers' Digest,* v. 10, Feb. 1949, p. 63-64. Translated and condensed from *Werkstatt und Betrieb,* v. 81, June 1948, p. 158-161.

Bar materials must be fed into the hollow spindles of capstan lathes and automatics through long extension tubes which can be designed as fixed or rotating tubes, with or without an internal elastic or shock-damping lining. Practical and mathematical analyses for medium and high-spindle speeds, resulting in design recommendations.

20A-146. Tailoring Sheet Metals With Saw Bands. H. J. Chamberland. *Sheet Metal Worker,* v. 40, Mar. 1949, p. 37-40.

Large savings in time and costs over conventional band sawing are cited for friction sawing, which, however, is applicable only to ferrous metals. High-speed and conventional sawing and their applications.

20A-147. Chip Breakers and Chip Formers. M. Lang. *Machinery* (London), v. 74, Mar. 10, 1949, p. 298-301. Translated and condensed from "Werkstattblatt 139 Spanformer und Spanformstufen", Ed. 1, July 1948, Carl Hanser Verlag, Munich, Germany.

Results of extensive experiments on methods for obtaining satisfactory chips (as small as possible) during machining operations. Two methods which give good results are: use of a chip breaker or chip-forming step on the rake face of the tool; and use of a special adjustable chip former on top of the tool.

20A-148. Sawing Attachment for Cutting Off Wedge-Shaped Washers on an Automatic. *Machinery* (London), v. 74, Mar. 10, 1949, p. 304-305.

20A-149. Light Drillpresses Are Versatile Tools. H. E. Linsley. *American Machinist,* v. 93, Apr. 7, 1949, p. 101-108.

Examples of ingenious setups that have been successfully operated in metalworking and that reduce production time or substitute for expensive special-purpose machines.

20A-150. Practical Ideas. *American Machinist,* v. 93, Apr. 7, 1949, p. 120-124.

Includes the following: automatic shop-made pinion cutter (Joseph F. Budnick); truing of inaccurate lathe-chuck jaws (Thomas Gray); spring mandrel clamps rings for accurate machining (Charles Schwartz); templet gage aligns multiple bits on high-production lathes (Stanley R. Welling); standard shapes reduce costs of jigs and fixtures (Harold Reaney); spring-loaded pin locates swinging bushing plate (Roger Isetts); 3-point cantilever beam aligns machine components (Michael P. Blake); surface gaging on magnetic table or chuck without cutting off power by use of nonmagnetic surface plate (James E. Avery); adjustable-angle parallel positions work in vise (Allan B. Nixon); lead pins align punch and die for hole punching (Henry G. Berndt); and other miscellaneous shop hints.

20A-151. Multiple Spindle Drill Heads—Their Applications and Characteristics. H. K. Ferger. *Machine and Tool Blue Book,* v. 45, Apr. 1949, p. 103-108, 110, 112.

20A-152. Special Tooling Aids Building of Automatic Machines. R. F. V. Stanton. *Modern Machine Shop,* v. 21, Apr. 1949, p. 102-106, 108, 110-111.

Some of the special tools used in the manufacture of high-speed tobacco-processing machinery.

20A-153. Handy Clamping Devices. Bernard J. Wolfe. *Modern Machine Shop,* v. 21, Apr. 1949, p. 168-170, 172, 174, 176, 178, 180, 182, 184.

Design and application of several practical clamping devices, primarily as applied in machining operations.

20A-154. Accurate Form-Grinding of Internal Surfaces. George H. DeGroat and Paul J. Koelbel. *Machinery,* v. 55, Apr. 1949, p. 146-148, 164.

How it is accomplished by application of an improved method of mounting the small grinding wheels employed in such operations.

20A-155. Automatic "Rough-Finish" Cycle Cuts Costs of Machining Bearings. *Machinery,* v. 55, Apr. 1949, p. 150-152.

New type engine lathe is making it possible for a Midwest manufacturer to increase his production of bronze and cast-iron sleeve bearings by as much as 700%.

20A-156. Hydraulic Mechanism for an Abrasive Cut-Off Machine. George H. DeGroat. *Machinery,* v. 55, Apr. 1949, p. 181-182.

20A-157. Tool Engineering Ideas. *Machinery,* v. 55, Apr. 1949, p. 183-186.

"Automatic Mechanically Operated Milling Fixture", Robert Mawson; "Designing Parts for Economical Die Production", Federico Strasser; "Lathe Dog for Gripping Narrow Shoulders", H. Moore; and "Internal Threading Tool Designed to Eliminate Set-Up Gages", W. G. Hallam.

20A-158. Regrinding of Jaws for Self Centering Chucks. J. R. Paquin. *Tool Engineer,* v. 22, Apr. 1949, p. 21.

Improved procedure.

20A-159. Portable Jig Borer. *Tool Engineer,* v. 22, Apr. 1949, p. 32-34.

Convair saves setup time with low-cost device especially adaptable to components too large to handle on stationary boring machines, and to fittings already installed on completed major assemblies.

20A-160. Common Machining Difficulties and Their Correction. *Tool Engineer,* v. 22, Apr. 1949, p. 43-44.

The tabular presentation, covering single point, flat, and circular forming tools, and multiple-point rotating tools.

20A-161. Mist Coolant System Improves Cutter Grinding. *Iron Age,* v. 163, Apr. 7, 1949, p. 92.

Equipment developed.

20A-162. A Jig and Fixture Program. H. C. Tsien. *Tool & Die Journal,* v. 15, Apr. 1949, p. 42-47, 82.

Design of three milling fixtures and two drill jigs which are proposed to complete all operations on a cast iron adjusting head.

20A-163. Jig and Fixture Designs. Robert Mawson. *Tool & Die Journal,* v. 15, Apr. 1949, p. 48, 50-51.

A welded drill jig and a positive boring fixture.

20A-164. Air-Actuated Holding Fixtures. *Tool & Die Journal,* v. 15, Apr. 1949, p. 52, 54, 56.

An air motor operates the holding fixture, actuates the feeding mechanism of the machine, and ejects the workpiece from the fixture by exhaust air.

20A-165. New Roll Grinding System Uses Abrasive Belts. *Steel,* v. 124, Apr. 11, 1949, p. 108.

Newly-developed system for roughing and finishing of all types of rolls, which can be used with or without removing them from the rolling machine. Rolls which are difficult to grind by other methods reportedly can be ground to close tolerances and to a fine finish by this method.

20A-166. Making Motor Car Fuel Pumps. *Machinery* (London), v. 74, Mar. 31, 1949, p. 395-401.

Forming and machine-shop operations.

20A-167. New Diamond Wheel Recommendations for Carbide Grinding. F. J. Benn. *Industrial Diamond Review,* new ser., v. 9, Mar. 1949, p. 75-77.

Recommendations with respect to selection of bond; grit size; grade or hardness; and diamond concentration. Operating hints.

20A-168. Production of Accurate Conical Holes. E. Muenchow. *Industrial Diamond Review,* new ser., v. 9, Mar. 1949, p. 80-84.

Special boring bar and auxiliary equipment said to have advantages over other methods. The equipment was developed in Germany.

20A-169. Hydraulic Equipment. Part I. Manufacture of Undercarriage Components at Electro-Hydraulics, Ltd.; Machining Methods; Deep Bores; Superfinishing. Part II. Manufacture of Components at Electro-Hydraulics, Ltd.; Machining Thin-Walled Work; Furnace Brazing; Fixtures. *Aircraft Production,* v. 11, Mar. 1949, p. 97-102; Apr. 1949, p. 136-140.

20A-170. Anchor Bushings; Spot-Welding Drill-Bushes to Flexible Templates. *Aircraft Production,* v. 11, Apr. 1949, p. 141.

New technique facilitates the drilling of curved surfaces. Each anchor bushing consists of a hardened steel bush pressed into a low-carbon steel anchor-plate; the lower end of the bush projects below the level of the anchor-plate and serves as a spigot for locating the bushing on the templet. Hole centers are first laid out in the usual way and a hole is formed to receive the spigot-diameter of the bush which is then inserted into the hole. The bushing is attached to the templet by a single spot weld at each end of the anchor-plate.

20A-171. Air-Hydraulic System Simplifies Design. Clarence Johnson. *Machine Design,* v. 21, Apr. 1949, p. 149-152.

By ingenious use of compressed air in conjunction with a hydraulic control system, many of the advantages of a hydraulic-feed system without its complications are realized. Developed in several sizes, it may be used for milling, drilling, or boring.

20A-172. Comparison of Productive Po-

tentialities of Machines and Cutting Properties of Instruments During Ordinary and Rapid Machining. (In Russian.) A. I. Kashirin and B. A. Sak-Shak. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Nov. 1948, p. 3-9.

Proposes a theoretical method for comparative evaluation. Productive potentiality and cutting properties are broken down into basic components which appear as variables in the proposed formulas.

20A-173. Efficient Methods of Cutting During Rapid Operation of Milling Machines. (In Russian.) M. N. Larin. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Nov. 1948, p. 9-13.

New equations for cutting rate are proposed on basis of investigation of factors influencing machining.

20A-174. Internal Cooling of Cutting Tools as a Means of Increasing Efficiency of Rapid Cutting. (In Russian.) B. T. Prushkov. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Nov. 1948, p. 20.

The temperature of a cutting instrument can be decreased 30%, thus allowing an increase of cutting speed, for ordinary steels, of 5-8%; for high speed steels, of 11-26%; and for hard-metal cutting tips, of 34%.

20A-175. Work of the VNII (War Scientific Research Institute) on Rapid Cutting of Metals. (In Russian.) *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Nov. 1948, p. 25-29.

Results of work on 28 specific problems by the Russian War Scientific Research Institute during the past 4½ years.

20A-176. Tools Equipped With Hard-Metal Tips Produced by "Glavinstrument MSS." (In Russian.) *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Nov. 1948, p. 29-32.

Different types of cutting tools produced by Soviet plant. Methods of their production and optimum conditions of application.

20A-177. Industrial Electronics and Its Application to Automatic Control of Linear Dimensions. (In Russian.) A. I. Boyarov, A. A. Fel'baum, and A. I. Shchukin. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Dec. 1948, p. 1-7.

The possibility of applying electron-tube circuits in machining to control of dimensions of the finished products. Such devices may be used to control thickness of the surface layer, its hardness, modulus of elasticity, and pressure of the cutting tool. Such control is much more sensitive than contact electrical-measurement apparatus.

20A-178. New Type of Milling Machines for Rapid Operation. (In Russian.) I. G. Turchaninov. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Dec. 1948, p. 7-9.

Convenient arrangement for adjustment of the cutting tools. Optimum conditions of operation.

20A-179. (Book.) **Handbook for Estimating Machining Times.** T. W. Gorgon. 163 pages. Machinery Publishing Co., Ltd., National House, West Street, Brighton, England. 12s. 6d. net.

For the use of rate-fixers, production planners, and others concerned with a rapid and accurate calculation of production times. Based on results of investigations in Britain, the Continent, and in the U. S., verified or adjusted by observations of the author. Production aspects of turning, milling, drilling, and grinding.

20A-180. (Book.) **Fine Surface Finish.** Sydney F. Page. 179 pages. Chapman & Hall, Ltd., 37 Essex St., London, W. C. 2, England. 16s.

Controlled surface finish, comparison of lubricated surfaces, and metallurgy of machined surfaces, machining, grinding, and operations employed to produce a fine surface, surface-finish measurements, and inspection-department requirements. Research on the subject, including such aspects as the influence of tool shape, tool material, and cutting fluids.

20A-181. (Book.) **Schleifen und Werkzeugschleifen.** (Grinding and Tool Grinding.) Ernst Widmer. 62 pages. R. Winter Verlagsbuchhandlung, Zurich, Switzerland.

Grinding wheel and grinding operations, tool grinding in particular being dealt with. Truing grinding wheels by diamond tools, the correct drag angle of the diamond being stressed. Grinding of hard-metal tipped tools.

20B—Ferrous

20B-38. The Gear Manufacturing Member. Fred H. Trickett. *Western Machinery and Steel World,* v. 40, Mar. 1949, p. 102, 105.

Procedures and equipment of Mayvill Gear Mfg. Co., Los Angeles.

20B-39. Machining Large Spherical Roller Bearings. *Machinery* (London), v. 74, Mar. 10, 1949, p. 291-294.

Methods and equipment at SKF Industries in the U. S.

20B-40. Zerspanungseigenschaften bleihaltiger und bleifreier Automatenstähle. (The Machinability of Lead-Containing and Lead-Free Free-Machining Steels.) Alexander Schepers and Richard Krauss. *Stahl und Eisen,* v. 68, Feb. 26, 1948, p. 90-91; discussion, p. 91-92.

Reviews recent German research. Compares properties of a soft leaded steel and high speed high-sulfur steels.

20B-41. Special Equipment Finishes Old's Rocker Arms. Chester Ricker. *American Machinist,* v. 93, Apr. 7, 1949, p. 116-117.

Equipment and procedures.

20B-42. Using Welded Construction for an 18-Spindle Automatic Boring, Forming and Drilling Machine. E. M. Barrett. *Machine and Tool Blue Book,* v. 45, Apr. 1949, p. 138-143.

20B-43. Ingenious Tooling Solves Broaching Problems. A. E. Rylander. *Tool Engineer,* v. 22, Apr. 1949, p. 31.

How broaching after assembly insures stay-put accuracy of steel and cast-iron mating parts of typewriter-carriage guides.

20B-44. Tool and Cutter Geometry. Carl F. Benner. *Tool & Die Journal,* v. 15, Apr. 1949, p. 62, 64-66.

Sketches and tables comparing common design characteristics such as relief and clearance angles on various tools of the same type. Design features of each tool.

20B-45. Work Size Control on Machine Tools. *Machinery* (London), v. 74, Mar. 24, 1949, p. 366-367.

British system of machine control using air-operated gaging equipment. High accuracy and magnification can be obtained.

20B-46. Speed Engraving—Glass Molds. *Ceramic Industry,* v. 52, Apr. 1949, p. 104-105.

Lathe attachment for producing a wide variety of shapes and contours—inside and outside—with precision and speed. A pattern can be repeated up to 92 times on the circumference of a mold, and in various sizes.

20C—Nonferrous

20C-9. Improving the Machinability of Aluminum Bronze. Vladimir A. Grodsky. *Metal Progress,* v. 55, Mar. 1949, p. 340-341.

Experimental results indicate that addition of 0.5-1.0% Pb will greatly improve machinability and not reduce, to any appreciable extent, mechanical, heat treating, forging, and welding properties of Al bronze.

20C-10. Slot-Milling Fixture With Automatic Ejector. *Machinery,* v. 55, Apr. 1949, p. 159.

Fixture designed for a high-speed milling machine for milling slots in 3/16-in. diam. brass rods.

20C-11. Production of Air-Cooled Copper Heads for Bristol Sleeve-Valve Engines. Part I. Development of Design and Machining of the Copper Base. *Aircraft Production,* v. 11, Mar. 1949, p. 75-79.

(To be concluded.)

20D—Light Metals

20D-8. Cutting Costs: Contour Sawing Aluminum. H. J. Chamberland. *Modern Metals,* v. 5, Mar. 1949, p. 17-20.

Six random applications of contour sawing to Al sheet, plate, castings, extrusions, and assemblies.

20D-9. Choosing a File for Aluminum. Stanley Livingston, Jr. *Modern Metals,* v. 5, Mar. 1949, p. 26-28.

Recommendations for obtaining maximum efficiency from files as well as filing production. Types of files to use for specific jobs.

20D-10. Windscreen Castings. *Aircraft Production,* v. 11, Apr. 1949, p. 127-130.

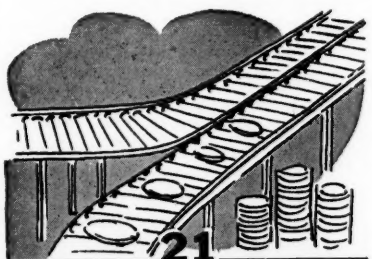
Procedures and equipment for fabrication of the frames for the windshields used on aircraft designed for operation under internal pressure at high altitudes. Machining, routing, and shaping of the Al-alloy castings used.

20D-11. Face Milling and Cutting Schedules for Rapid Working of Silumin. (In Russian.) N. G. Vinogradov and I. M. Dmitriev. *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Dec. 1948, p. 10-11.

Effects of various factors. Composition of alloy is given.

For additional annotations indexed in other sections, see:

3B-73; 14C-29; 19B-57; 24A-60



21 MISCELLANEOUS FABRICATION

21A—General

21A-26. Costs Cut 50% by Modern Casket-Fabricating Methods. H. A. Neff. *Steel,* v. 124, Mar. 28, 1949, p. 78, 80.

Production methods at two plants of the Belmont Casket Mfg. Co. Forming operations take place at one plant, while the other is used

to weld, finish, and assemble the caskets.

21A-27. Manufacturing the Alvis Leonides. *Aircraft Engineering,* v. 21, Mar. 1949, p. 76-84.
Equipment and procedures for manufacture of Britain's only 500-hp. airplane engine. Design details.

21A-28. Aircraft Fixtures Adapted to Building Bus Bodies. Walter Rudolph. *Automotive Industries,* v. 100, Apr. 1, 1949, p. 42-44, 70.

21A-29. Butt-Marking Tool. *Aircraft Production,* v. 11, Apr. 1949, p. 114.
Simple device for scribing skin panels which aids in accurately fitting them together.

21A-30. Convair: One of the Most Modern Production Lines in the World. Thomas A. Dickinson. *Western Metals,* v. 7, Apr. 1949, p. 28-31.
Production of different airplanes and parts.

21B—Ferrous

21B-18. Sink Production at American Central. Walter Rudolph. *Finish,* v. 6, Apr. 1949, p. 19-22, 76.
Fabrication, pickling equipment, porcelain enameling, handling, and automatic equipment for packaging.

21B-19. Alkaline Batteries; Some Notes on the Production of C.A.V.-Nife Cells. *Automobile Engineer,* v. 39, Mar. 1949, p. 114-117.
Design and fabrication methods and equipment. Manufacture of perforated steel strip used in plate construction by special punching equipment; assembly; and welding the all-steel containers.

21B-20. Manufacture of Auto Tire Chains. N. J. Gebert and A. M. Roberts. *Plating,* v. 36, Apr. 1949, p. 349-354.
The more important operations involved are: forming; link welding; twisting; bar welding; heat treating; polishing; plating; assembling; and inspection. (The plating step given greatest emphasis.)

21C—Nonferrous

21C-2. Precious Metals in Los Angeles. Gordon B. Ashmead. *Western Machinery and Steel World,* v. 40, Mar. 1949, p. 82-85.
Facilities of Handy and Harman for preparation of bars, sheet, and other forms for the jewelry manufacturer. Scrap recovery procedures; melting, refining, rolling, drawing, and annealing.

For additional annotations indexed in other sections, see:

7B-66; 22D-26; 23C-20; 24A-63

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22A—General

22A-78. Stud Welding Gun. *Plastics* (London), v. 13, Mar. 1949, p. 120-121.
Gun uses plastic housing which has proven satisfactory in service.

22A-79. Arc Welding Data Charts for Drawing Office and Workshop. (Continued.) R. J. Fowler. *Welding,* v. 17, Mar. 1949, p. 117-121, 129.
Standard work charts. Chart for estimation of electrode quantities.

22A-80. Tooling for Welding; Notes on Jig and Fixture Design. S. J. Pugh. *Welding,* v. 17, Mar. 1949, p. 122-125.
Some recommendations for designing jigs and fixtures suitable for high-speed projection welding. Practical examples.

22A-81. High-Speed Recording of Arc Welding Phenomena. L. H. Orton and J. C. Needham. *Welding,* v. 17, Mar. 1949, p. 126-127.
Use of oscillographic equipment.

HERE'S HOW . . .

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22A-82. Bonding of Steel to Cast Aluminum and Uses Thereof. C. E. Stevens, Jr. *Metal Progress*, v. 55, Mar. 1949, p. 326-331.

A steel cylinder liner chemically bonded to aluminum exterior fins was found to have vastly better heat transfer than the conventional finned-steel construction. Bimetallic casting techniques and properties of the joint. The Al-Fin process has been extended successfully to the manufacture of brake drums and power-tube radiators, to aluminum gearing with steel hubs, and to steel-backed bearings. Mechanical test procedure.

22A-83. Rubber Bonding. Part 1. W. J. S. Naunton and J. M. Buist. *India Rubber Journal*, v. 116, Mar. 19, 1949, p. 15-16. A condensation.

Experiments made with three types of organic bonding agents and different types of metals.

22A-84. Miniature Spot Welding Electrodes. *Machinery Lloyd* (Overseas Edition), v. 21, Mar. 12, 1949, p. 81-82.

Electrodes and their fixtures as designed for welding of small components used in electron tubes.

22A-85. Techniques for Spot Welding. Frederick S. Dever. *Welding Engineer*, v. 34, Apr. 1949, p. 46-51.

Recommendations for designer and welder. Applications. Spot-weld charts developed to facilitate setups. Inspection procedures.

22A-86. What Welding Means to America. Part Three: Machinery—Electrical and Non-Electrical. T. B. Jefferson. *Welding Engineer*, v. 34, Apr. 1949, p. 54-56.

Results of a survey showing application of different types of welding in different plants.

22A-87. Big Welders in Czechoslovakia. Beth Fisher. *Welding Engineer*, v. 34, Apr. 1949, p. 62, 64.

Large flash welder and large spot welder made in Czechoslovakia.

22A-88. A Survey of Modern Theory on Welding and Weldability. D. Séférian. *Sheet Metal Industries*, v. 26, Mar. 1949, p. 597-604; Apr. 1949, p. 827-835.

Begins series which will examine present-day technique and application in the light of modern theory and control methods. March: The fundamentals of various types of welding flames. April: the technique of oxy-acetylene welding and distinguishing characteristics of the different oxy-acetylene methods. (To be continued.)

22A-89. New Self-Heating Tape Simplifies Soldering Operations. Robert B. Stanton. *Materials & Methods*, v. 29, Apr. 1949, p. 57.

Tape consists of a ribbon of lead-tin solder attached to a ribbon of vinyl plastic, in which aluminum-type heating fuels are dispersed. It has been used successfully to assemble Cu, brass, Sn, Al, Fe, Zn, and related types of alloy wires and fabricated sheet stock in thicknesses up to approximately 0.2 in.

22A-90. Salt-Bath Brazing. *Metallurgia*, v. 39, Mar. 1949, p. 257-259.

Some of the advantages of the method; information obtained as a result of development work.

22A-91. Comparative Strengths of Some Adhesive-Adherend Systems. N. J. DeLollis, Nancy Rucker, and J. E. Wier. *National Advisory Committee for Aeronautics*, Technical Note No. 1863, Mar. 1949, 43 pages.

Adhesives evaluated were polyvinyl acetate, cellulose nitrate, resorcinol resin, casein, gum arabic, natural rubber, and neoprene. "Adherends" were stainless steel, Al alloy, paper-phenolic laminate, glass, birch wood, and hard rubber. The properties studied were double-lap shear, tensile, long-time loading shear, and impact strengths.

22A-92. Le collage du caoutchouc aux métaux a l'aide de nouveaux dérivés chimiques du caoutchouc. (Bonding Rubber to Metals by Means of New Chemical Derivatives of Rubber.) Jacques Gossot. *Revue Générale du Caoutchouc*, v. 26, Apr. 1949, p. 273-278.

In attempting to find a non-thermo-plastic bonding agent, various rubber derivatives were studied. The acrylonitrile derivative gave the most encouraging results. General process for bonding rubber to metal was developed.

22A-93. Neue Erkenntnisse uber die Vorgänge im Schweisslichtbogen von Mantelelektroden. (New Facts on Electric-Arc Reactions of Coated Welding Electrodes.) W. Hummitzsch. *Schweisstechnik*, v. 2, May 1948, p. 50-54; June 1948, p. 67-70; July 1948, p. 84-89.

Results of recent research, including composition of the arc atmosphere, theory of ionization, and movement and neutralization of ions. The nature and behavior of a.c. and d.c. arcs in welding. It is shown that the melting efficiency of coated electrodes is proportional to the ionization energy of the coating substances. 10 ref.

22A-94. (Book.) **The Properties of Soft Solders and Soldered Joints.** J. McKeown. 118 pages. 1948. British Non-Ferrous Metals Research Association, Euston Street, London, N.W. 1, England. $4.00 (17s, 6d).

Investigations and results obtained in a war-time research to increase knowledge of the properties of solders having lower tin contents.

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22B—Ferrous

22B-107. Arc Welding and Flame Cutting—An Aid to Production. E. F. Gill. *Sheet Metal Industries,* v. 26, Mar. 1949, p. 606-608.

Savings achieved on a specific steel casting.

22B-108. Fusion Welding and Cutting of Alloy Steel as Used in Modern Steam Locomotive Boilers, and Report on Welded Boilers Now in Service. *Master Boiler Makers' Association, Official Proceedings,* 1948, p. 87-128.

Part One is devoted to the practical aspects of the welded boilers. Part Two is devoted to the metallurgical and technical phases of welding alloy steels that might be used in the construction of welded boilers. Includes the following papers: "Steels and Edge Preparation of Same for the Construction of Welded Boilers," A. J. Raymo; "Welding Test of Nickel Steel for Use in Locomotive Boilers," J. W. Crossett; "Notes on the Weldability and Mechanical Properties of Manganese-Vanadium Plate Steel," T. W. Merrill; "Fusion Welding and Cutting of Alloy Steel for Locomotive Boilers," Howard L. Miller; "Welding of Chromium-Molybdenum Alloy Steel Pressure Piping," E. R. Seabloom; and "High Temperature Applications of Alloys in Boiler Design and Manufacture," M. C. Jessen.

22B-109. Making Rings of Stainless Steel. R. Groves. *Metallurgia,* v. 39, Feb. 1949, p. 217-219.

A method of manufacture in which two half-rings are joined by pressure welding; and advantage and limitations of the process.

22B-110. The Thermit Process; Developments — Applications — Possibilities. *Welding,* v. 17, Mar. 1949, p. 94-103.

Principles and progress of thermit welding. Examples of some important modern applications of the process both in Britain and overseas. Reconditioning of rolling-mill housings and stern-frame repairs.

22B-111. Motor Car Production. 3. Assembly Methods at Vauxhall Motors, Ltd. *Welding,* v. 17, Mar. 1949, p. 105-116.

Emphasis is on welding jigs.

22B-112. Untersuchungen zur Metallurgie des Ellira-Schweissverfahrens. (Research on the Metallurgy of the Ellira Welding Process.) Friedrich Bischof. *Stahl und Eisen,* v. 68, Feb. 26, 1948, p. 92-93.

Reviews recent German literature on submerged-melt process. 14 ref.

22B-113. Stand der Zusatzwerkstoffe fur die Eisenschweissung. (Additives Used in the Welding of Iron.) K. L. Zeyen. *Zeitschrift des Vereines Deutscher Ingenieure,* new ser., v. 90, June 1948, p. 185-190.

A survey of German, English, Russian, and American welding-rod improvements since the beginning of World War II, with special emphasis on the effect of phosphorus, sulfur, and hydrogen on the quality of the weld. 25 ref.

22B-114. Conductors Stress-Relieve Welds. C. C. Roberts. *American Machinist,* v. 93, Apr. 7, 1949, p. 97.

Use of electric cables wrapped around welded pipe joints for preheating, stress-relief, and controlled cooling. Includes thermocouples and temperature controller.

22B-115. Soldering. *Nature,* v. 163, Mar. 19, 1949, p. 459. Based on talk by W. R. Lewis.

Recent developments in theory and practice.

22B-116. Pipe Lines Across the Desert. Elton Sterrett. *Welding Engineer,* v. 34, Apr. 1949, p. 33-35.

Procedures for joining high-tensile alloy steel pipe.

22B-117. From Plate to Penstocks. Fred M. Burt. *Welding Engineer,* v. 34, Apr. 1949, p. 40-43.

Equipment and procedures. Operations include fabrication of 15-ft. penstocks and large vessels for oil refining.

22B-118. Arc-Welded Jack Steps Up Production. Harry P. Krull. *Welding Engineer,* v. 34, Apr. 1949, p. 44-45.

Fabrication of roller floor jack to support transfer case and transmission for assembly in a road grader.

22B-119. Welded Steel Forms Build Bridge Supports. Herbert Leopold. *Welding Engineer,* v. 34, Apr. 1949, p. 52-53.

Steel forms fabricated by arc welding used in construction of Australian bridge.

22B-120. Welding 4 to 6 pct. Chrome Pipe. *Iron Age,* v. 163, Apr. 7, 1949, p. 102.

Satisfactory procedure for large oil-refinery piping.

22B-121. Economy of Steel and Cast Iron by Welding. *Transactions of the Institute of Welding,* v. 12, Feb. 1949, p. 3-9.

Committee report. Bridge building, electrical, general, marine and structural engineering, shipbuilding and other applications of welding processes. Cost data.

22B-122. Short Time Phenomena in the Iron Welding Arc. Metal Bridging and Short Circuiting of the Arc. L. H. Orton and J. C. Needham. *Welding Research,* v. 3 (bound with *Transactions of the Institute of Welding,* v. 12), Feb. 1949, p. 17r-24r.

Existence of the phenomena in a d.c. downhand welding-type iron arc and in a.c. welding. Short-circuiting phenomena were recorded oscillographically. These short circuits are arbitrarily divided into four classes according to their durations. The mode of occurrence and the characteristics of these phenomena. Possible explanations.

22B-123. Welding of Railroad Cars Simplified by Use of Huge Positioners. John W. Sheffer. *Machinery,* v. 55, Apr. 1949, p. 160-163.

22B-124. Furnace Brazing Small Steel Parts. I. H. M. Webber. *Industrial Heating,* v. 16, Mar. 1949, p. 402-404, 406, 408, 410, 412, 418.

Procedures developed to improve quality, shorten manufacturing cycles, and reduce costs. Numerous cases were found where forgings, castings, and parts machined from bar stock could be fabricated from less expensive components. Describes specific cases, including methods previously used. (To be continued.)

22B-125. Speeds Welding 25% With Heavier Current. Delbert Craven. *Industry and Welding,* v. 22, Apr. 1949, p. 45.

Installation of 500-amp. AC Fleetwelders which eliminate arc blow and speed welding. Welds are said to be more easily made and of higher quality.

22B-126. New Brazing Techniques for Auto Bodies and Fenders. Carl E. Jacobs. *Industry and Welding,* v. 22, Apr. 1949, p. 46-48, 50.

Procedures include removal of scale with flame, piercing holes in sheet, aligning, and tacking.

22B-127. Assembly Operations in Motor Car Body Production. *Machinery* (London), v. 74, Mar. 24, 1949, p. 353-365.

Layout equipment, and procedures. The bulk of the assembly work consists of welding using a wide range of equipment sizes.

22B-128. Redesigning Metal Parts for Electric Furnace Brazing. H. M. Webber. *Materials & Methods,* v. 29, Apr. 1949, p. 58-62.

Careful redesign permits combining inexpensive metal forms into low-cost fabricated products of complex design. Use of copper brazing on low-alloy and stainless steels.

22B-129. Beitrag zur Frage der Schweissbarkeit der Hoch- und Bruckenbaustähle. (The Weldability of Structural Steels.) A. Legat. *Schweisstechnik,* v. 2, Jan. 1948, p. 5-8; Feb. 1948, p. 15-18.

The metallurgy of weldable structural steels. Effects of melting method, of type and quantity of the deoxidizing agent, of grain structure, and of alloying ingredients. 28 ref.

22B-130. Zur Frage der Beanspruchbarkeit verschieden dicker Kahlnähte. (The Problem of Stress of Fillet Weld Seams of Varying Thicknesses.) H. Melhardt. *Schweisstechnik,* v. 2, Apr. 1948, p. 37-39.

Determination of tensile-stress properties of fillet welds by mathematical and experimental methods. Methods of calculating strength values.

22B-131. Die Praxis der Gusseisenschweissung. (Cast Iron Welding.) Valentin Trunschitz. *Schweisstechnik,* v. 2, Apr. 1948, p. 43-46.

Methods.

22B-132. Stumpf - und Kehlnahtverbindungen bei ruhender und bei wechselnder Beanspruchung. (Butt and Fillet Joints Under Static and Alternating Stresses.) H. Melhardt. *Schweisstechnik,* v. 2, May 1948, p. 55-57; June 1948, p. 72-75.

A partial comparative evaluation of test results on welded joints. The inclination of the δ_o-line in the fatigue-strength diagram and Babeck's coefficients for the seam form.

22B-133. Das Schweissen von rost-, säure- und hitzebeständigen Stählen. (The Welding of Rust, Acid, and Heat Resistant Steels.) W. Hummitzsch. *Schweisstechnik,* v. 2, Oct. 1948, p. 119-128.

Basic data on the properties of the above steels and their preparation for welding, welding methods, and welding rods. The Arcatom and Argonarc processes. A method of soldering rust and acid resistant steels.

22B-134. (Book.) **Oxygen Cutting: A Comprehensive Study of Modern Practice in Manual and Machine Cutting.** E. Seymour Semper. 150 pages. Louis Cassier Co., Ltd., Dorset House, Stamford St., London, S.E. 1, England. 10s. 6d. (postage 5d.).

Approaches subject mainly from the practical side, although the theoretical has not been neglected.

22B-135. (Book.) **Hardfacing by Welding.** M. Riddihough. 127 pages. Louis Cassier Co., Ltd., Dorset House, Stamford St., London, S.E. 1, England.

Hardfacing Rods and Their Development; Designing the Deposit; Designing for Specific Jobs; Characteristics of the Metals Commonly Used for Blanks; Preheating and Cooling; Heat Treatment for Hardfacing Various Types of Metals; Equipment and Jigs for Hardfacing; Hardfacing Techniques; Inspecting, Machining and Grinding the Deposit; Estimating and Planning. Appendix lists details of English and American hardfacing materials.

22D—Light Metals

22D-21. Developments in the Metallurgy and Technique of Welding Aluminium Alloys. P. T. Houldcroft. *Metallurgia,* v. 39, Feb. 1949, p. 206-209.

High-strength, medium-strength, and new medium-strength alloys;

cracking; welding generators; and Argonarc, resistance and pressure welding. 46 ref.

22D-22. Heliarc Welding Light Metals. *Modern Metals,* v. 5, Mar. 1949, p. 31-35.

Process, equipment, and applications. Details for different types of Al and Mg welds.

22D-23. Quick Welding of Aluminum Products. William Lukemeier. *Welding Engineer,* v. 34, Apr. 1949, p. 36-37, 73.

Simple fixtures for inert-gas-shielded arc welding which enable rapid production of aluminum showerstall bases and reinforcing frames for milk-bottle cases. Neither fluxing nor finishing are required.

22D-24. Rebuilding Wheels of Mine Locomotives. *Welding Engineer,* v. 34, Apr. 1949, p. 38-39.

Use of submerged-melt welding for the above.

22D-25. The Pressure-Butt Welding of Light Alloy Bar. R. F. Tylecote. *Welding Research,* v. 3, (bound with *Transactions of the Institute of Welding,* v. 12), Feb. 1949, p. 2r-16r.

The materials investigated were Al and Mg alloys representative of those available commercially. Details of apparatus, temperature-measurement procedure, surface preparation, and welding procedure. Chemical composition and physical properties of the alloys used. Temperature gradients, influencing factors, and effects on weld strength. Properties and macro and microstructures.

22D-26. Are You Fabricating Sheet Metal? L. R. Jones. *Industry and Welding,* v. 22, Apr. 1949, p. 26-29, 65.

Use of carbon-arc with solder on light gage metal with a Si-bronze filler rod. Distortion elimination, arc welding, handling, finishing, research and development, and welding of stainless-clad and Inconel-clad metals.

22D-27. Boeing's Stratojet. Howard E. Jackson. *Industry and Welding,* v. 22, Apr. 1949, p. 38-41, 44.

Resistance welding practice. Control and inspection methods.

22D-28. Aluminum Passenger Car Parts. *Railway Mechanical Engineer,* v. 123, Apr. 1949, p. 209-211.

Welding and bending equipment and procedures in the production of aluminum furniture and other equipment.

22D-29. Aluminum Wire. Part II. Welding for Wire-drawing. J. Hutchinson. *Wire and Wire Products,* v. 24, Apr. 1949, p. 336-338; discussion, p. 360-363.

General principles, recommended procedures for spot and butt welding light-alloy rod before wire drawing, and advantages and disadvantages of the two procedures. (To be continued.)

22D-30. Reparaturschweissung an einem 6-Zylinder-Leichtmetall-Motorblock. (Repair Welding on a 6-Cylinder Light-Metal Engine Block.) Friedrich Deutsch. *Schweisstechnik,* v. 2, Apr. 1948, p. 42.

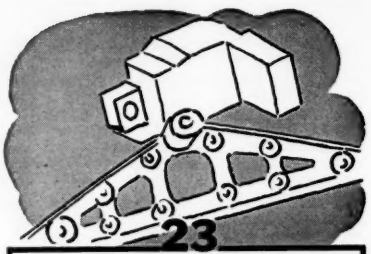
Methods for repair job.

22D-31. Die elektrische Lichtbogenschweissung des Aluminiums und seiner Legierungen. (Electric Arc Welding of Aluminum and Its Alloys.) E. Hawlik. *Schweisstechnik,* v. 2, June 1948, p. 75-76; July 1948, p. 82-84.

A successful method of welding aluminum and its alloys. Proper kind of Al electrodes, welding apparatus, and electrical conditions. Photographs, microphotographs, and radiographs of welded seams.

For additional annotations indexed in other sections, see:

3B-73-74; 3C-58; 18A-12; 20B-42



23 APPLICATIONS

23A—General

23A-6. Mechanical Features of Steel-Backed Bearings. E. Crankshaw. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 150-164; discussion, p. 205-207.

Mechanical features, methods of fabrication, and applications.

23A-7. Materials at Work. *Materials & Methods,* v. 29, Apr. 1949, p. 68-70.

Rubber-coated oil tank which resists fire and high temperatures; all-welded Al truck body; powdered-bronze machine part; Mo seamless tube (experimental product); glass bearing (demonstration unit); Ni-Cr-Mo steel axles; nylon commutator-segment washers; and phenolic chuck jaws which eliminate marring.

23A-8. (Book.) **Sleeve Bearing Materials.** R. W. Dayton, editor. 256 pages. 1949. American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio.

A series of educational lectures. Individual papers abstracted separately.

23B—Ferrous

23B-17. Treated Carbon Steel Substituted for Alloy in Studs. *American Machinist,* v. 93, Mar. 24, 1949, p. 99.

Used in the manufacture of certain studs for automotive and farm machinery, the above substitution has eliminated heat treating after machining. Studs have greater uniformity and smoother finish combined with a lower operating cost.

23B-18. Notes on Stainless Steel. *Sheet Metal Worker,* v. 40, Mar. 1949, p. 43, 73.

Properties and applications. Hints on fabrication procedures.

23C—Nonferrous

23C-19. Cadmium vs. Lead Batteries. D. H. Kelly. *Metals,* v. 19, Mar. 1949, p. 7-8, 14.

Refutes claims of recent *Popular Science Monthly* and *Reader's Digest* article which stated that Europeans are 40 years ahead of the U. S. with their superior cadmium batteries. Claims that cadmium batteries are actually inferior to the lead type, and are not widely used even in Europe.

23C-20. Copper in Electronic Tubes. R. Carson Dalzell. *Electronics,* v. 22, Apr. 1949, p. 164-170.

Properties required for this use; properties of the different commercial types; types of glass-copper seals; and miscellaneous fabrication methods.

23C-21. British Thought and Practice; How They Differ From American. W. H. Tait. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 35-55; discussion, p. 55-58.

Various differences believed mainly due to the American tendency to demand less long-term serviceability as opposed to lower costs and greater speeds of production.

23C-22. Newer Bearing Materials. I. C. Sleight and L. W. Sink. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 60-81; discussion, p. 136-137.

Three general classes—silver, aluminum, and grid bearings. Design, bearing requirements, manufacturing processes, and properties.

23C-23. Discussion of Wrought (or Rolled) Bushings and Bushing Materials. Harry P. Croft, E. G. Mitchell, Verne Hoover, and John K. Anthony. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 140-145.

Reasons why wrought (or rolled) bushing materials are used extensively in many and varied applications in preference to sand castings. Production methods, structures, properties, and compositions of seven alloys of this type.

23C-24. Aircraft Engine Bearings. J. Palsulich and R. W. Blair. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 223-234.

The type of bearing materials used in aircraft engines and the methods of inspection used to insure the highest quality. Mechanical and corrosion tests to which new materials are subjected, and successful design practices.

23C-25. Selection of Bearing Materials in the Electrical Industry. D. F. Wilcock. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 235-240.

Principles to be considered with regard to bearings for instruments, switchgear, fractional horsepower motors, integral horsepower motors, and turbines, generators and gears.

23C-26. Brass and Bronze for Electrical Springs. Arthur I. Heim. *Electrical Manufacturing,* v. 43, Apr. 1949, p. 114-117, 204, 206.

Relative properties and applicabilities of 70-30 cartridge brass, high Si bronze, 5% and 8% phosphor bronze. One of these four types is usually the answer to any application involving springs for electrically operated products.

23C-27. Dictated by Design. *Die Castings,* v. 7, Apr. 1949, p. 34-39, 46-48.

An endless-belt electronic recorder retooled for quantity production, which makes use of Al die castings to cut weight, and zinc die castings for sturdy, thin-sectioned housing with superior surface finish.

23C-28. Erfahrungen mit Bleibronze-Verbundguss im Schiffsturbinenbau. (Experiences With Lead-Bronze "Bonded" Castings in Marine Turbine Construction.) Kurt Springorum. *Die Neue Giesserei,* v. 36 (new ser., v. 2), Feb. 1949, p. 49-51.

Experience with turbine bearings lined with lead-bronze alloy. The superiority of the latter to babbitt metal.

23C-29. Matériaux pour résistances électriques et éléments de chauffage; Elektrische Widerstandsmaterialien und Heizleiter. (Electrical Resistance Materials and Heating Elements.) Th. Zurrer and H. Bovet. *Pro-Metal,* v. 2, Feb. 1949, p. 304, 306, 311-315.

Different types of resistance metals; their production, properties, and specific uses—especially as heating elements for hot plates, ovens, and furnaces. 10 ref.

23D—Light Metals

23D-22. Aluminium Alloys in Mining Equipment. J. C. Bailey. *Colliery Guardian,* v. 178, Mar. 10, 1949, p. 303-311. A condensation.

Properties, available forms, and applications.

23D-23. Light-Alloy Bearings. *Light Metals,* v. 12, Mar. 1949, p. 127-129. Based on FIAT Review: "German Science, 1939-1946. Non-Ferrous Metallurgy. Part II. Light Metals," R. Weber, E. Schmid, and H. Mann.

Summarizes data on aluminum alloy bearings. 31 ref.

23D-24. "Rolled" Sheet Aluminium Splints. A. P. Bertwistle. *Light Metals,* v. 12, Mar. 1949, p. 160-161.

Mode of preparation, advantages, patterns, and use of splints for various bone fractures.

23D-25. The Use of Aluminium Alloys in Building. E. I. Brimelow. *Metallurgia,* v. 39, Feb. 1949, p. 195-202.

Differences between the physical properties of aluminum alloys and of steel in relation to their structural and architectural use. Use of aluminum in housing and prefabricated unit construction. Factors governing selection, such as durability. Desirability of further research, especially on water pipes. 19 ref.

23D-26. Putting on the Pressure. *Die Castings,* v. 7, Apr. 1949, p. 32, 44-45.

The "Durol" vulcanizing press used by European garage mechanics consists of a heavy H-section frame designed for bench mounting, a lower spring-loaded anvil, and an electrically heated pressure pad assembled from four Al die castings.

23D-27. Magnesium Die Castings Offer Weight Saving and Low Cost Advantages. R. C. Cornell. *Materials & Methods,* v. 29, Apr. 1949, p. 43-46.

The case for die castings of Mg as compared to those of Al and Zn. Applications for which all three were considered.

23D-28. Light-Alloy in the Petroleum Industry. *Light Metals,* v. 12, Mar. 1949, p. 131-133.

The scope and operations of the oil industry. Use of aluminum and magnesium in the industry. (To be continued.)

23D-29. Aluminum Dredge Designed for Difficult Placer Job. John B. Juttl. *Engineering and Mining Journal,* v. 150, Apr. 1949, p. 72-75.

Use of Al alloys cuts over-all weight of dredge about 100 short tons and decreases mean draft 10 in.

23D-30. Aluminum Truck Bodies Adopted for Longer Life. *Food Industries,* v. 21, Apr. 1949, p. 108-109.

In carrying meat products, their corrosion resistance and lower repair bills more than offset higher initial cost. Construction details.

For additional annotations indexed in other sections, see:

3A-77-85; 3B-58-70; 3C-72-77; 5A-23-25; 5B-8; 5C-7; 7D-19; 14B-42; 19A-94-98

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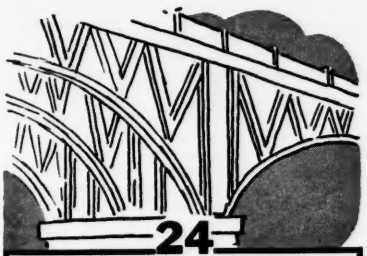

24—DESIGN

24A—General

24A-51. Estimating Upset Forgings. Albert P. Berberich. *American Machinist,* v. 93, Mar. 24, 1949, p. 141, 143.

Table and diagrams to aid in estimating material required in upset forgings and for calculating cavities of upsetting dies for stock diameters from ⅛ to 4 in.

24A-52. Bending of Beams With Creep. E. P. Popov. *Journal of Applied Physics,* v. 20, Mar. 1949, p. 251-256.

A method of calculating stresses and deflections. Complete tension-creep data at constant temperature are used to define creep characteristics of the material. Stresses and deflections may be calculated for any desired time interval including time prior to the occurrence of steady-state creep. 12 ref.

24A-53. Designing for Gas Turbine Materials. M. H. Young. *Aviation Week,* v. 50, Mar. 21, 1949, p. 20-22, 24-25.

The various factors involved; comparative mechanical properties of different high-temperature materials; effects of design changes on performance.

24A-54. Lubrication. E. Crankshaw and J. Menrath. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 165-173; discussion, p. 205-207.

Formulas for calculating amount of lubrication required and effects of design on amount of oil which will flow under given pressures.

24A-55. Neue Wege der Festigkeitsrechnung. (New Methods of Calculating Strength Properties.) E. Siebel. *Zeitschrift des Vereines Deutscher Ingenieure,* new ser., v. 90, May 1948, p. 135-139.

Proposes that the calculation of strength values be based on the theoretical maximum elasticity of nonuniformly stressed structural parts, regardless of whether they are subjected to static or fatigue stresses. Compares strength behaviors of materials under uniform and nonuniform stresses. Calculation of different types of stress. 10 ref.

24A-56. Die-Casting Practice and Technique. VIII. Associated Design Problems. W. M. Halliday. *Metal Industry,* v. 74, Mar. 11, 1949, p. 189-192; Mar. 18, 1949, p. 211-213; Mar. 25, 1949, p. 223-225.

Need for accuracy; gravity dies, manner of ejection of products, gravity-die design, and gravity-die construction.

24A-57. The Plastic Yielding of Notched Bars Under Tension. R. Hill. *Quarterly Journal of Mechanics and Applied Mathematics,* v. 2, Mar. 1949, p. 40-52.

The state of stress in the core of a notched bar is analyzed at the moment when pronounced plastic yielding begins. The theory is two-dimensional and an ideal plastic-rigid material is assumed. Following a general analysis of the problem, the magnitude of the strain factor is calculated for a deep notch with a semi-circular root. The correct approach to problems of plane plastic strain is illustrated by re-examination of the classical work of Prandtl on indentation. 14 ref.

24A-58. The Distribution of Stress in the Neighborhood of a Crack. T. J. Willmore. *Quarterly Journal of Mechanics and Applied Mathematics,* v. 2, Mar. 1949, p. 53-63.

Determines by complex-variable methods the above distribution in the neighborhood of a two-dimensional Griffith crack when pressure varies along the crack. The analysis is extended to deal with problems involving cracks in aeolotropic materials possessing two directions of elastic symmetry. Stress distribution in the neighborhood of two collinear cracks of equal length; formulas for shape of the cracks and critical tensile stress normal to the cracks which will produce rupture.

24A-59. Using Head Shapes to Cut Costs. Herbert A. Ottey. *Product Engineering,* v. 20, Apr. 1949, p. 81-85.

Varied applications of tank heads, or head shapes, for simpler construction of machine elements wherever all or a portion of the element is in the form of a surface of revolution. These are made by hot or cold forming or spinning.

24A-60. The Design of Surface Broaches. II. Artur Schatz. *Machinery,* v. 55, Apr. 1949, p. 138-145.

Effect of such factors as type of machine used, machining operation, and methods employed in making the broach.

24A-61. Composite Dimensioning for Concentricity. J. T. Bennett. *Machinery,* v. 55, Apr. 1949, p. 153-155.

Incorporating diametral and eccentricity tolerance in one dimension results in increased production and fewer rejected parts.

24A-62. Plastic Buckling of Simply Supported Compressed Plates. Richard A. Pride and George J. Heimerl. *National Advisory Committee for Aeronautics,* Technical Note No. 1817, Apr. 1949, 22 pages.

Validity of various theories was investigated by means of local-instability tests on drawn square tubes of 14S-T6 Al alloy. Results obtained were in excellent agreement with Stowell's unified theory for plastic buckling of columns and plates. Two other theories of the deformation type and the empirical secant-modulus method also gave close correlation with results, but a plastic-buckling theory of the flow type showed lack of agreement. 11 ref.

24A-63. Metal Parts for Solid Propellant Rockets. L. G. Bonner. *Journal of the American Rocket Society,* Mar. 1949, p. 9-15.

Work which needs to be done on problems of design and fabrication. Problems result from emphasis on minimum weight and the exceedingly short total useful life of the assembly. Materials, Al alloys, and design.

24A-64. What Goes on in a Spring During Presetting? *Mainspring,* v. 12, Apr. 1949, p.1-5.

On many compression springs the last operation before shipping is "pre-setting"—performed by compressing and releasing the spring a few times to prevent it from taking permanent set on use. In some cases the load limit is raised as much as 30%. Simplified explanation of the theory behind this effect.

24A-65. Concerning Plastic Bending. (In Russian.) V. P. Romanovskii. *Zavodskaya Laboratoriya* (Factory

Laboratory), v. 14, Dec. 1948, p. 1456-1461.

A theoretical analysis of the state of stress during plastic bending. Formulas for accurate calculation of bending moments. Application of these formulas, taking into consideration the displacement of the neutral layer, is of value for determination of permissible radii of bending.

24A-66. New Method for Plotting Diagrams of True Stresses. (In Russian.) A. I. Chipizhenko. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 14, Dec. 1948, p. 1469-1475.

Method which, in common with usual methods, expresses plasticity of metals on the basis of reduction in area of the test specimen. However, it permits establishment of new relationships and more correct evaluation of states and properties of the investigated metal. Theoretical bases.

24A-67. (Book.) **Diamond Tool Patents. III. Truing of Grinding Wheels.** W. Jacobsohn. 88 pages. Industrial Diamond Information Bureau, Industrial Distributors (Sales) Ltd., London.

Contains 500 abstracts of British, American, and German patents referring to design, arrangement, or use of particular truing devices. Compilation is limited to the years 1916 to 1946.

24B—Ferrous

24B-14. Recommended Practices for Staybolt Application and Maintenance. *Master Boiler Makers' Association, Official Proceedings,* 1948, p. 136-193.

Includes "Tools Used in Threading Thread Gages and Tolerances, Gaging Methods," G. R. Greenslade; "Seal Welding of Staybolts," E. E. Owens; "Specifications for Staybolt Iron, Solid and Hollow Rolled"; "Specifications for Boiler and Firebox Steel"; "Notes on the Design and Construction of Staybolted Locomotives," Fred P. Huston; "The Welding of Staybolts," by Howard L. Miller and L. E. Grant; and other items.

24B-15. Why Dies Break. David R. Edgerton. *Machine and Tool Blue Book,* v. 45, Apr. 1949, p. 123-126, 128, 130-134, 136.

Reasons for some failures, and recommendations for selection of materials, design of tools, and inspection procedures.

24B-16. Cost and Weight Advantages Obtained With a Welded Sheave. A. T. Scannell. *Machinery,* v. 55, Apr. 1949, p. 188.

60-in. diam. welded steel sheave is 60% lighter and 68% cheaper than a cast-iron sheave. Other advantages are greater safety, longer life, and elimination of maintenance work normally required.

24B-17. An Analysis of Blanking Die Designs. C. W. Hinman. *Modern Machine Shop,* v. 21, Apr. 1949, p. 134-136, 138, 140, 142.

Basic data on the construction of a simple blanking die.

24B-18. Significant Strength of Steels in the Design of Machine Parts. I. Charles Lipson, G. C. Noll, and L. S. Clock. *Product Engineering,* v. 20, Apr. 1949, p. 142-146.

Quantitative evaluation of the effect of individual factors on the determination of allowable strength to be used in design. Factors include static loading, alternating loading, combined loading, surface finish, and hardness. Construction of significant strength diagrams and their application to the different types of load. (To be continued.)

24B-19. Die Dauerfestigkeit von Schweissverbindungen als Berechnungsgrundlage fur geschweisste Brucken. (The Fatigue Strength Properties of Welded Joints as a Basis for Design of Welded Bridges.) Folkhard. *Schweisstechnik,* v. 2, Aug. 1948, p. 93-103.

A series of test results were analyzed to determine the factors that affect fatigue-stress resistance of welded joints and to find ways of increasing permissible stresses on welded bridges. 22 ref.

24C—Nonferrous

24C-3. Railroad Journal Bearings. E. S. Pearce. *American Society for Metals,* "Sleeve Bearing Materials," 1949, p. 241-248.

Major emphasis is on journal-bearing design. Materials also briefly discussed.

24C-4. Die Casting Die Design. Part III. (Continued.) H. K. Barton and James L. Erickson. *Tool & Die Journal,* v. 15, Apr. 1949, p. 58, 60, 74, 76.

Loose die components, number of cavities, shut off area, thermal balance, venting, and dimensional tolerances. (To be continued.)

24C-5. Wooden Die Model for Complex Part. *Die Castings,* v. 7, Apr. 1949, p. 24-26, 43.

Six-part die for the main frame of the Seeburg Select-O-Matic record player in which 37 holes are cored. Frame construction and die layout problem.

24C-6. Gear Assembly by Die Casting. *Die Castings,* v. 7, Apr. 1949, p. 28-30, 44.

Gear design of the Fold-A-Matic ironer. Designers have used zinc die castings to obtain accurately toothed gears where the loading permits, and have used inserts of other metals to good effect.

24D—Light Metals

24D-3. Data on the Compressive Strength of 75S-T6 Aluminum-Alloy Flat Panels With Longitudinal Extruded Z-Section Stiffeners. William A. Hickman and Norris F. Dow. *National Advisory Committee for Aeronautics,* Technical Note No. 1829, Mar. 1949, 21 pages.

Concerned with panels in which the ratio of thickness of stiffener material to skin material varies from 0.4 to 1.0 and ratio of stiffener spacing to skin thickness from 15 to 40.

24D-4. Just Skating Along. *Die Castings,* v. 7, Apr. 1949, p. 22-23, 42.

Improvements made by Globe-Union in the weight, strength, appearance and simplified production of rink roller skates. Shoe plates were redesigned to substitute a single Al die casting for several stamped and cast parts.

For additional annotations indexed in other sections, see:

3D-25; 19A-89-95; 19D-27; 20A-157; 20B-44; 22A-80; 22B-120; 23C-27; 23D-26

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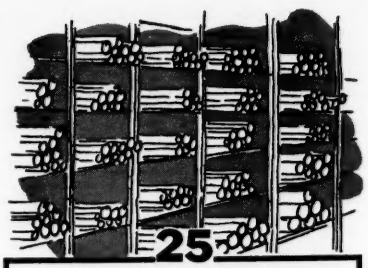

25 MISCELLANEOUS

25A—General

25A-50. Pen and Ink Mark Gages. R. Kaden. *American Machinist,* v. 93, Mar. 24, 1949, p. 123-124.

How identification marks can be applied to metal tools by use of India ink, followed by Glyptol-Vinylite coating, and baking. Oils and cutting fluids encountered in machine shops do not affect the coating; nor is it subject to wear from handling.

25A-51. Allis-Chalmers Put Through Extensive Research Program in 1948. *Blast Furnace and Steel Plant,* v. 37, Mar. 1949, p. 345-346.

Projects and results obtained.

25A-52. Lowdown on New Uses for High Vacuum. *Modern Industry,* v. 17, Mar. 15, 1949, p. 46-49.

Miscellaneous industrial metallurgical and nonmetallurgical uses.

25A-53. The Frictional Behaviour of Engineering Materials. R. C. Parker. *Engineering,* v. 167, Mar. 4, 1949, p. 193-196; Mar. 11, 1949, p. 217-219.

The usually accepted law of proportionality of friction to "coefficient of friction" times load is subject to wide variations, partly as a result of effect of large loads on structure of the sliding surfaces. Experimental work on metallic and nonmetallic brake linings using full-scale and reduced-scale equipment. Scaled-down tests are shown to give unsatisfactory results. Concluding installment discusses the relative value of service and full-scale laboratory tests.

25A-54. Metallic Friction and Surface Damage at Light Loads. J. R. Whitehead. *Research,* v. 2, Mar. 1949, p. 145-147.

Electron micrographs show surface damage due to steel sliding on electropolished aluminum under loads of 0.3, 75, and 150 g. Aluminum oxide and Formvar replica techniques were used.

25A-55. Northwest Power. Ivan Bloch. *Western Metals,* v. 7, Apr. 1949, p. 32-38.

Production and power consumption by various primary and secondary metal industries.

25A-56. Molybdenum Disulphide as a Lubricant. *Alloy Metals Review,* v. 7, Mar. 1949, p. 2-8.

Molybdenum disulphide possesses a remarkable capacity for preventing galling and seizing at bearing pressures well over 45 tons per sq. in. and at either high or low velocities. Experimental work indicates that its lubricating properties are due to its unique structure. Each lamina of this compound is composed of a sheet of Mo atoms with a sheet of S atoms on each side. One of these adheres strongly to the metal surface because of the metal-sulfur bond. The others slip

(*Turn to page* 59)

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262. Bearings, Bronze

New 16-page booklet No. 3 lists hundreds of sizes and types of Compo oil-retaining bearings along with additional data on formulas, tolerances and specifications. Bound Brook Oil-Less Bearing Co.

263. Castings

A 36-page booklet, entitled "Mechanized for Quality Castings" contains numerous illustrations of conveyor systems and other modern equipment, including two extensive mold lines. Forest City Foundries Co.

264. Copper Plating

Technical data sheet on Rocheltex, new liquid addition agent which can be added to any cyanide copper plating solution and used in any type of equipment. MacDermid Inc.

265. Corrosion

Technical bulletin No. 3 gives physical and chemical properties and suggested uses of a group of surface active agents known as Alox 350. Alox Corp.

266. Electrodes, Container

Announcing a new Arcaloy AC-DC stainless electrode and new all-steel, moisture-proof and grease-proof container. Packed in containers made to simplify stock problems, these new electrodes produce the cleanest welds in the industry. Alloy Rods Co.

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Announcing the 50th anniversary of Frankite, an attractive two-color booklet gives a complete picture story of the many and varied uses of "tailor-made" irons in industry. Frank Foundries Corp.

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Latest copy of Tempil Topics gives a concise summary of the flame hardening process. Tempil Corp.

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Five booklets now available describe fully with interesting illustrations the different heat-bath processes including carburizing, tempering, and a superior black finish. Heatbath Corp.

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274. Stainless Steels

New booklet describing leading brands of stainless, heat resisting, tool and die steel. Typical analysis and applications included for each brand. Jessop Steel Co.

275. Surface Control

New 8-page bulletin gives numerous practical advantages of shop control for surface roughness and waviness. Write for "More Profits to You Through Surface Control". Physicists Research Co.

276. Tube Furnace

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277. Universal Tester

New Multi-Low-Range universal tester. Bulletin M gives full description of operation with photographs of all parts. W. C. Dillon & Co.

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Bulletin 711 includes the latest information on forged steel relief valves, designed for basic steam, oil, or vapor working pressure of 600 lb. at 850° F. Edward Valves, Inc.

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METALLURGICAL ENGINEER: Age 28, married. B.A.Sc. in met. eng. One year's experience in general steel plant work, and ferrous metallurgical research. Desires position in either production or development, where there are good possibilities of promotion. Location unimportant. Box 5-40.

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(Continued on opposite page)

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25A—Miscellaneous

(*Continued from page* 56)

easily because of the weakness of the S-S bond.

25A-57. The Chemical News Parade: Chemists Aid Dental Research. *Chemical and Engineering News,* v. 27, Apr. 11, 1949, p. 1068-1069.

National Bureau of Standards work on dental materials (metallic and nonmetallic).

25A-58. Oscillatory Sliding Friction (The Frictionless Bearing). (Continued.) Stephen Thyssen-Bornemisza. *Microtecnic* (English Edition), v. 3, Jan.-Feb. 1949, p. 22-33. Translated from the German.

Results of investigation revealed a surprisingly great decrease of the coefficient of friction with increased oscillation speed of the shaft. In most of the experiments a decrease to 3-7% of normal friction was observed, although one experiment resulted in a reduction of 0.3% of normal. Work was limited to friction of steel on steel.

25A-59. (Book.) **Your Career in the Metallurgical Profession.** John W. W. Sullivan. *American Society for Metals,* 7301 Euclid Ave., Cleveland 3, Ohio. 96 pages, $1.00.

Written for students, this booklet paints a bright picture of the opportunities of the metallurgical profession. The different types of work and problems awaiting solution are enumerated. Concludes with case histories of 13 up-and-coming metallurgists.

25A-60. (Book.) **Process and Physical Metallurgy.** James E. Garside. 499 pages. 1949. Charles Griffin & Co., Ltd., 42 Drury Lane, London, England.

Extraction methods and processes are only lightly touched upon. Methods of fabrication such as casting processes are dealt with more fully. Physical methods involving X-rays, electrical and magnetic measurements are not described. Chapters on temperature measurement, on metallography, on heat treatment and on surface hardening of steel on welding; also on specific alloy types and on metals for specific uses (type metals and bearing metals).

25A-61. (Book.) **Sources of Engineering Information.** Blanche H. Dalton. 109 pages. 1948. University of California Press, Los Angeles. $4.00.

Information on every type of engineering, including aeronautics, electronics, illumination, electrical engineering, mechanical engineering, metals and metallurgy, petroleum engineering, mining engineering, civil engineering, materials testing, ventilation, hydromechanics. Important source material.

25B—Ferrous

25B-21. Die Energiekosten eines gemischten Eisenhuttenwerkes und ihre Verrechnung auf die Erzeugnisse. (The Cost of Energy Consumed in a Steel Plant and the Distribution of the Costs to the Products.) Kurt Rummel. *Stahl und Eisen,* v. 68, Aug. 12, 1948, p. 294-301.

25B-22. Planung grosstechnischer Sauerstoffanlagen. (Planning Large Commercial Oxygen Plants.) Ernst Karwat. *Stahl und Eisen,* v. 68, Dec. 2, 1948, p. 453-465.

Planning the above requires a survey of the required degree of purity and saleable amount of oxygen. Calculations on the estimated oxygen requirements of metallurgical industries. Graphs and tables indicate the energy required to separate the oxygen from air. Layout of an oxygen plant.

25B-23. Italian Steelmakers Aim at Modern Plant, Competitive Prices. Bill Packard. *Iron Age,* v. 163, Apr. 14, 1949, p. 130-132.

Plans of "Finsider," a semi-official group of Italian steel producers. Integrated plants are slated to play an important role in future of the industry.

25B-24. Rank of L. S. Iron Ore Producers in 1948. *Skillings' Mining Review,* v. 37, Apr. 9, 1949, p. 1, 4.

Iron-ore shipments of 28 companies from 164 mines. Rank and gross tons shipped in 1918, 1928, and 1938.

25B-25. (Book.) **Stahl-Handbuch.** (Iron and Steel Handbook.) Walther Hiller. 326 pages. R. Bohmann, Industrie und Fachverlag, Doblhoffgasse 5, Vienna I, Austria. $3.80.

Encyclopedia reviews metallurgical principles, alloys of steel, steel for special purposes, manufacture of steel, heat treatment, physical properties. Primarily intended for tool engineers, machine designers.

25C—Nonferrous

25C-25. World Position of Non-Ferrous Metals. Ralph L. Wilcox. *Metals,* v. 19, Mar. 1949, p. 9-11.

Report from Non-Ferrous Metals Branch, Economic Cooperation Administration.

25C-26. Review of Zinc Industry for Year 1948. Part II. (Concluded.) Ernest V. Gent. *Metals,* v. 19, Mar. 1949, p. 12.

25C-27. Bibliography on Production & Properties of Titanium. Charles S. DuMont. *Metal Progress,* v. 55, Mar. 1949, p. 368, 398, 400, 402, 404.

References are derived mainly from the author's 180-page bibliography published in 1947. 20 additional references are given. Classified as general, production, and properties. 114 ref.

25D—Light Metals

25D-14. L'industrie suédoise de l'Aluminium. (Swedish Aluminum Industry.) Valde Oskarson. *Revue de l'Aluminium,* v. 26, Feb. 1949, p. 40-42.

Survey from 1921 to date. Method used, amount produced, and the main application of Al. Includes drawings and tables.

25D-15. Commercial Wrought Aluminum Alloys. J. A. Nock, Jr. *American Society for Metals,* "Physical Metallurgy of Aluminum Alloys," 1949, p. 167-199.

Alloy classification, heat treatable and non heat treatable wrought alloys, Alclad products, formability, welding and brazing, corrosion resistance, products available, and applications. 18 ref.

25D-16. (Book.) **Physical Metallurgy of Aluminum Alloys.** W. L. Fink, F. Keller, W. E. Sicha, J. A. Nock, Jr., and E. H. Dix, Jr. 247 pages, 1949. American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio. $5.00.

A series of educational lectures. Individual lectures are abstracted separately.

25D-17. (Book.) **Aluminium.** (In Norwegian.) Jan Herman Reimers. 324 pages. 1947. Johan Grundt Tanum, Oslo, Norway.

A reference work suitable for use by research men or graduate students. All phases from production of metal to fabrication of primary shapes and finished products. Properties and applications. Norwegian installations.

NEW PRODUCTS *in Review*

805. Ductility Tester

A new bench model ductility testing machine for determining the drawing qualities of sheet metal is very compact (only 2 ft., 11 in. high and 26 in. across) and has an exceptionally fast cycle.

Speed of piston travel is adjustable by a simple dial setting. Complete tests can be made in as little as 15 sec. Capacity is 15,000 lb. to cup-test material up to ⅛ in. thick, or 30,000 lb. for material up to ¼ in. thick.

This new model is motorized and hydraulically operated. It incorporates two concentric pistons. The outer piston grips the test piece against the head at top of the machine while the inner piston makes the cup in the specimen. The pressure gage has a maximum indicating hand to show pressure at which yield in the specimen occurs. A depth indicator reads directly the depth of draw at any moment.

For further information write Louis A. Welt, Steel City Testing Machines, Inc., 8843 Livernois Ave., Detroit 4, Mich., or use coupon on page 57, circling No. 805.

806. Turbo-Hearth Process

A new method of making steel rapidly in a vessel called a "turbo-hearth" is the result of joint research by Carnegie-Illinois Steel Corp., Jones & Laughlin Steel Corp., and Battelle Memorial Institute. In the turbo-hearth, steel of openhearth quality, low in phosphorus and silicon, is manufactured by directing jets of air across the surface of the white hot liquid pig iron.

The turbo-hearth was developed in an attempt to combine the advantages of the basic openhearth and acid bessemer processes. Turbo-hearth steel is made in a partly closed, side-blown vessel, lined with basic refractory.

The brick lining of the vessel is magnesia rather than silica. As in the bessemer process generally, heat is supplied by chemical reaction of the blown air with carbon and other elements of the charge. Chemical action is fast and direct, but subject to controlled conditions which reduce the nitrogen and phosphorus contents, making turbo-hearth steel comparable to openhearth steel, hence suitable for more general use than the customary bessemer steel.

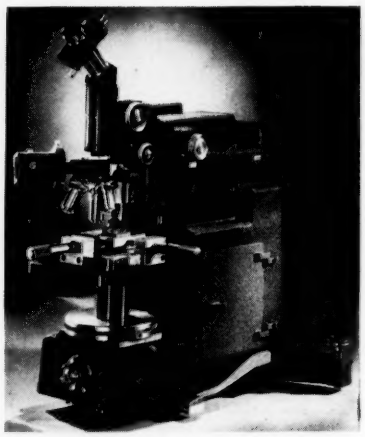
The metallurgical feasibility of the process has been demonstrated by the results of preliminary tests using small-scale units. These tests have provided sufficient background for the design and construction of a full-sized furnace in which operating problems may be studied.

For further information write Robert J. Wilcox, Carnegie-Illinois Steel Corp., Frick Annex, Pittsburgh, Pa., or use coupon on page 57, circling No. 806.

807. Microhardness Tester

A new microhardness tester known as the Kentron accurately applies dead-weight loads as light as 1 g., for use with either the Knoop or the Vickers type indenter. Thus, it opens new avenues in the microhardness testing of minute particles, inclusions, constituents, thin metals, transition zones of welds, wire, and foil.

The Kentron tester is a bench-type instrument, hand-operated to eliminate vibration. An oil dash pot, for controlling the speed of load application and time of load retention, is easily adjusted to suit specific testing requirements. A specially built mechanical stage, consisting of the stationary plate, transfer plate and specimen block, provides an easy and convenient means for locating and positioning the exact area of the test specimen underneath the indenter and microscope.

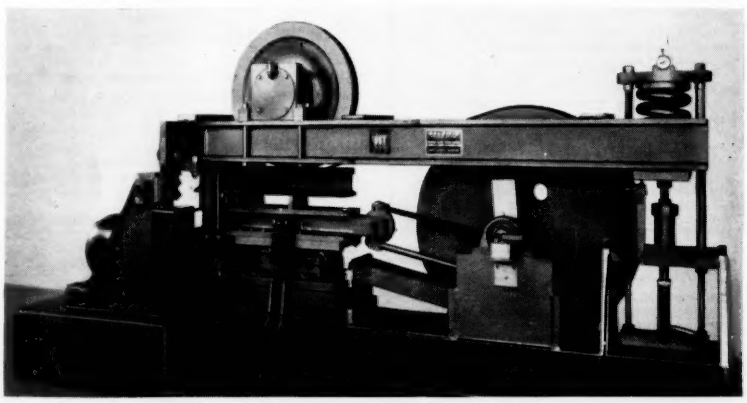


For further information write Kent Cliff Laboratories, Peekskill, N. Y., or use coupon on page 57, circling No. 807.

808. Rail Fatigue Machine

A new machine for applying rolling fatigue loads simulates service conditions on railroad rails.

Rail sections about 50 in. long



Baldwin's Rolling Load Fatigue Machine

and up to 8 in. high are mounted longitudinally on a reciprocating carriage, 12 in. of the section being a cantilever. Loads ranging from 6250 to 80,000 lb. are applied on the cantilever as it moves with a 12-in. stroke at 125 cycles per min. Maximum bending moment in the rail may be 960,000 in.-lb. The number of cycles to failure is registered by a revolution counter.

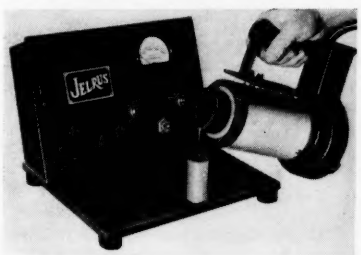
Load is applied by a 32½-in. diameter loading wheel mounted on a loading beam. This beam is pivoted and held at one end by two horizontal and two vertical steel flex plates. The beam is loaded at the other end by a hydraulic jack through a spring, the deflection of which is measured by a dial indicator. The beam multiplies loads by five.

The reciprocating carriage moves on two supporting rollers and is preloaded by springs to counteract inertia forces of reciprocating parts. It is driven by a 10-hp. motor through a large V-belt sheave that serves as a flywheel, and by a crank with 6-in. throw.

In addition to determining the endurance life remaining in rail sections that have wheel-burned impressions caused by spinning locomotive wheels, the machine can also be used for other rolling load tests.

For further information write M. K. Wright, Baldwin Locomotive Works, Philadelphia 42, Pa., or use coupon on page 57, circling No. 808.

809. Small Melting Furnace



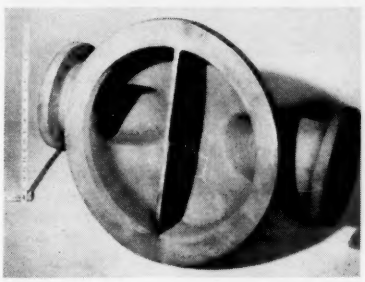
The Jelrus Handy-Melt portable electric furnace is a relatively inexpensive apparatus for controlled electric melting of nonferrous metals. The entire furnace weighs only 5 lb. and can be lifted by hand at the moment the pyrometer indicates the proper pouring temperature.

The furnace operates on 110-volt current, either a.c. or d.c. Top temperature limit is 2000° F. Capacity is 20 troy oz. of gold, 25 troy oz. of silver, or 1½ lb. of brass. The crucible is made of graphite to provide a reducing atmosphere and eliminate oxidation of metal during melting.

For further information write H. G. Yaruss, the Jelrus Co., Inc., 136 West 52nd St., New York 19, N. Y., or use coupon on page 57, circling No. 809.

810. Large Pressure Castings

Pressure castings of unusual size and design made of 99% nickel have recently been poured by Stainless Foundry & Engineering Co. Other



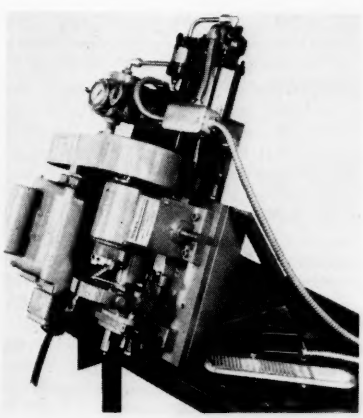
types of castings are also being produced from monel and Inconel. In order to accommodate their expanding production volume, the company is now building a large plant addition, which will more than double existing floor space and capacity.

For further information write John McBroom, Stainless Foundry & Engineering Co., Milwaukee, Wis., or use coupon on page 57, circling No. 810.

811. Tube End Finishing

Automatic air operation is now available for simplified, high-speed tube deburring and other end finishing operations on the Series 600 tube and rod end finishing machine. This small, bench-model machine has an air cylinder operated by foot switch with hydro-check control. This leaves the operator's hands free to handle work up 2 in. diameter at production speeds of 800 to 1200 tube ends an hour.

A vertical mounting base is an optional accessory used for gravity unloading of short workpieces. The patented chuck and work-feed action is taken from direct pull of the air cylinder. The work travels rapidly to and from the tool, with an adjustable hydro-check to control the feed speed and depth of cut. A work positioning



stop and adjustable "depth-of-cut" stop combine to provide a high degree of accuracy.

Changeover time for the replaceable chuck jaw inserts and threaded tool holder to fit work diameter is only 60 sec. A selection of eight spindle speeds is obtained from the step sheave V-belt drive. The maximum range of the machine is 2 in. work diameter. Tooling can be furnished for other end finishing operations such as center drilling, rod chamfering, drilling, reaming, pointing and boring, in addition to tube deburring.

For further information write D. F. Bomer, Pines Engineering Co., Inc., 695 Walnut St., Aurora, Ill., or use coupon on page 57, circling No. 811.

812. Cleaning Formula

Quaker Formula 100 is a "synergized" synthetic cleaner, developed to replace vapor degreasing, solvent cleaning, solvent emulsion cleaning, and electrolytic cleaning for the removal of soils of the mineral oil type. It is a powder product used at concentrations of 2 to 3 oz. per gal. of water in a tank. Temperature range is 180° F. to boiling.

Immersion time of less than 2 min. is required to prepare metal surfaces for bonderizing, electroplating and painting. Quaker Formula 100 can be applied to steel, brass, and aluminimum.

For further information write J. M. Mylroie, Quaker Chemical Products Corp., Conshohocken, Pa., or use coupon on page 57, circling No. 812.

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NEW PRODUCTS *in Review*

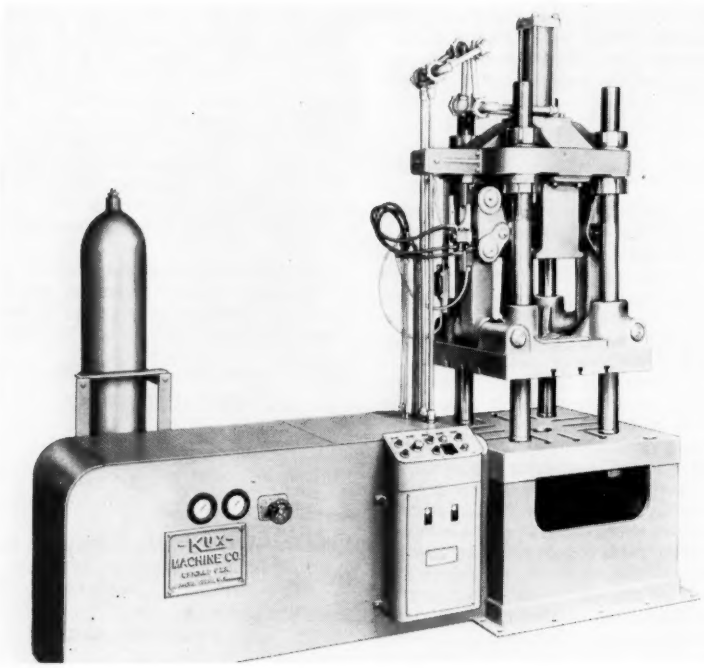
813. Vertical Die Caster

The latest cold chamber die casting machine of vertical-type construction to be offered on the market is the Kux Model HP-22. It is designed specifically for production of parts that have inserts cast in.

Die plates are mounted in a horizontal position but operate in a vertical direction. Thus, castings with inserts can be placed in the lower die half and remain in place all through the die casting cycle without falling out of the cavity. Castings such as electric motor rotors, flywheel and magneto parts having magnet insert, and parts with cast-in bushings, can be easily made.

The Model HP-22 is hydraulically operated and electrically controlled. It will produce castings weighing up to 4½ lb in aluminum and has a die space 17¾ in. square between bars.

For further information write James J. Kux, Kux Machine Co., 3924 West Harrison St., Chicago, or use coupon on page 57, circling No. 813.



Kux Vertical Die Caster

814. Virgin Metal Policy

The policy of using only "virgin materials" in the manufacture of high-alloy castings has been announced by Fahralloy Corp. Exhaustive laboratory and field tests have indicated that the common practice of using appreciable percentages of used alloy scrap could result in lowered service life of finished castings. In the past the company held the use of such scrap down to approximately 1½% of the metal charged.

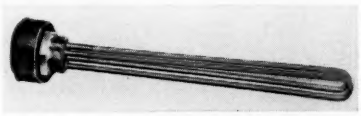
Now, in order to take all known precautions to insure the production of sound castings it has adopted the policy of using only virgin materials throughout the process. By the melting of only pure metals, by using the most efficient deoxidation and degassing practices and by casting into uncontaminated refractory molding materials, the company has taken another step in the production of castings that will render a greater service life.

For further information write Francis Fahrenwald, Fahralloy Corp., Harvey, Ill., or use coupon on page 57, circling No. 814.

815. Immersion Heaters

A new series of all-stainless or all-inconel Chromalox electric immersion heaters can be used for heating a wide range of industrial chemicals, strong alkaline cleaners, extra-heavy degreasing solutions, oils of high sulphur content, and many other viscous and corrosive liquids.

These heaters are constructed of hairpin-shaped heavy-duty Chromalox tubular elements welded into a solid screw plug with 2-in. standard pipe thread and a heavy 3-in. hex section. The heating elements are die-pressed to a patented triangular cross section to obtain high mechanical strength and a dense refractory. This good electrical insulation between the sheath and the resistor wire provides a maximum degree of heat transfer.



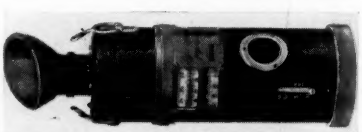
Heating elements, screw-plug, and welded joints are made of Type 347 stainless steel (18-8Cb stabilized), or of inconel. The heated length of the element ranges from 12 to 50 in. Ratings from 1 to 15 kw. are available in voltages of 230, 460, and 550, single phase.

For further information write George Sowash, Edwin L. Wiegand Co., 7558 Thomas Blvd., Pittsburgh 8, Pa., or use coupon on page 57, circling No. 815. (In writing the company, mention solution to be heated and the recommendation of its supplier as to which metal should be used.)

816. Openhearth Pyrometer

The new Pyro openhearth optical pyrometer is especially designed for taking temperature readings in the limited range required for molten ferrous metals.

The reading scale has been lengthened over 40% and covers only the critical portion of the temperature range required. The standard temperature scale for black body conditions covers from 2200 to 3000° F.; an additional scale in red, corrected for the emissivity of molten iron, steel, monel and similar alloys, reads from 2400 to 3300° F. Both scales



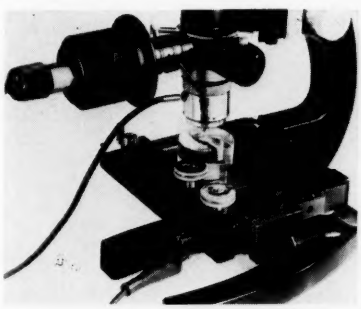
are subdivided into wide 10° divisions so that actual temperature readings can be made to within a very few degrees.

This greatly expanded scale gives higher accuracy and easier temperature readings. The black body scale is applicable for measuring temperatures of furnaces, ovens, linings, and fireboxes, while the red scale gives direct and practically instantaneous readings of spout, pouring and ladle temperatures of molten ferrous alloys.

For further information write Paul V. Bollerman, Pyrometer Instrument Co., Inc., Bergenfield, N. J., or use coupon on page 57, circling No. 816.

817. Microhardness Tester

The MH microhardness indenter is a new instrument for measuring hardness of microconstituents, fine wire, metallic foils, electrodeposited coatings, minerals and organic substances. It is adaptable to conventional table microscopes, versatile, simple to operate, and low in cost.



The focusing mechanism of the microscope is used to produce indentations by the Vickers diamond penetrator, which is mounted interchangeably with the microscope objective. Resulting impressions are measured optically, and values obtained are in terms of standard Vickers hardness.

The unit is provided with 25 and 50-g. dead-weight loading, low-friction jewel bearings, and indicating lamp assembly. Hardness conversion charts are furnished with the instrument.

For further information write John W. Norcross, Erb & Gray, 854 South Figueroa St., Los Angeles 14, Calif., or use coupon on page 57, circling No. 817.

818. Pulverizer

An efficient pulverizer for grinding small samples from 3 to 20 g. will reduce 4 or 8-mesh material to 50-mesh screen or finer. The pulverizer has been used successfully to grind a wide variety of materials of varying hardness. To grind a 5-g. sample takes only 1 to 4 min., depending upon the hardness of the material.

The apparatus is essentially a small high-speed hammer mill with fixed (non-pivoting) hammers. The rotor is made of Stellite and other parts are made of hardened steel. Loss or contamination of the sample is negligible.

The body of the apparatus is mounted on a shaft between two side plates so that it can be pivoted upside down for easy cleaning.

For further information write Lee P. Blattner, Precision Scientific Co., 3737 West Cortland St., Chicago 47, Ill., or use coupon on page 57, circling No. 818.

819. Metal Brightener

An improved brightener for copper, brass and bronze is known as Metal Brite. It imparts natural colors to these metals and gives a fine degree of polishing. One part of Metal Brite is diluted with two parts of water, and the brightening operation takes only 15 to 30 sec.

For samples or further information write Harry Smith, Kelite Products, Inc., Box 2917 Terminal Annex, Los Angeles 54, Calif., or use coupon on page 57, circling No. 819.

820. Two-Tank Cleaning Process

An improved "Lo-Hi" process for the preparation of metals for plating and vitreous enameling is a two-tank cleaning procedure. It not only removes soil of all types, regardless of the quality of the steel, but also activates the surface of the ware, completely conditioning it for ground coat.

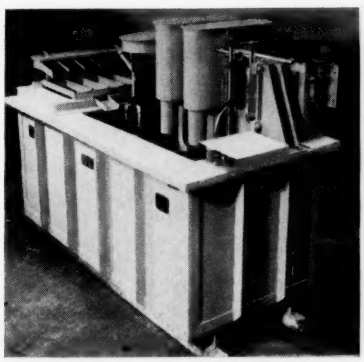
The Lo-Hi process, in addition to being economical and easily controlled, will dissolve light surface rust and soften scale. Because of the thorough cleaning and surface activation of the metal, savings in pickling time or acid concentration, or both, may be expected. The cleaning cycle is 5 min. in each tank with no intervening rinse.

For further information write H. J. McCracken, Northwest Chemical Co., 9310 Roselawn Ave., Detroit 4, Mich., or use coupon on page 57, circling No. 820.

821. Isothermal Quench Salt Bath Furnace

Two requirements of a salt bath quenching furnace for martempering and austempering are (*a*) rapid and uniform cooling of the work, and (*b*) a fool-proof method of extracting the high-temperature chloride salts carried over from the austenitizing bath.

The new Ajax isothermal quench furnace satisfies the first need by providing a vigorous, upward flow of molten salt in headers, into which the hot work is introduced. The salt is circulated by submerged pumps. A separate pump for each header concentrates a great volume of liquid salt into a confined quenching area. Hardnesses are obtained equivalent to oil quenching together with the reduced distortion and elimination of quench cracks provided by martempering and austempering.



To solve the second requirement, a separate steel tank is built into one end of the unit. A motor-driven pump lifts the salt from the isothermal quench bath to a trough above the separation tank. This trough is cooled constantly by a blast of air which chills the salt to the optimum separating temperature—well below the operating temperature of the quench bath. The chloride contaminant is precipitated out of solution and collected in wire-mesh filter baskets, while the purified nitrate salt —still molten—enters the separation chamber. From there it flows back into the isothermal quench bath, so that the whole cleaning process is on a continuous basis.

For further information write Miss Ann E. Hamilton, Ajax Electric Co., Inc., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa., or use coupon on page 57, circling No. 821.

HOLDEN

SALT BATHS FOR CERAMIC POTS

HIGH SPEED STEEL HEAT TREATING

High Speed Pre-heat 12-16.

Melting point 1100°F. Working range 1250-1650°F. Other uses: Hardening tool steels, hardening production parts.

High Speed 17-23A.

Melting point 1700°F. Working range 1800-2350°F. Other uses: Hardening high carbon, high-chrome or air-hardening steels. Copper brazing.

HOLDEN SALT BATHS FOR HARDENING, ANNEALING, AND BRAZING

Operating Temperatures—1000 to 2000°F.

Hardbrite.

Melting point 1380°F. Working range 1450-1950°F. Uses: Hardening high-carbon, high-chrome steels; air hardening tool steels. Water and Oil hardening tool steels. Hardening stainless steels. Descaling stainless steels; 300 series, rods or forgings. Brass brazing.

Hardening 11-16.

Melting point 1100°F. Working range 1250-1650°F. Uses: Hardening SAE or NE steels. Annealing carbon steels. Hardening tool steels. Silver brazing. Heating medium spinning and forming steels. Isothermal heat treating (a) hardening (b) annealing.

Hardening 8-15.

Melting point 925°. Working range 1000-1550°F. Uses: Tempering high speed steels. Hardening tool steels. Hardening production parts. Spheroidizing annealing steels. Silver brazing. Isothermal quenching.

Holden Makes 40 Salt Bath Products

For every heat treating function from 300 to 2350°F. Annealing, hardening, tempering, austempering and martempering both ferrous and non-ferrous metals, and many other uses.

Free Engineering Service

Have you tried HOLDEN WATER SOLUBLE SALT BATHS?

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